

[No. 73.]

[PRINTED FOR THE USE OF THE COMMISSIONERS ONLY.]

## Metropolitan Sewers.

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# CONCISE STATEMENTS

OF

THE MAIN FEATURES

OF

THE PLANS

FOR

THE DRAINAGE OF THE METROPOLIS,

SENT IN PURSUANCE OF THE RESOLUTION OF THE COURT, 20TH AUGUST, 1849.

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HENRY AUSTIN, Esq.

I ANXIOUSLY avail myself of the opportunity afforded by the Court, of presenting a summary of the main features of the plans which I have prepared for the improvement of the drainage of the Metropolis, in order to protect myself from the erroneous assumption that has from time to time been put forth, to the effect that the system which I have proposed for the drainage of the *low* districts of the Metropolis, is one that I intend should be equally carried out over the *whole area*.

I should have considered myself little worthy of the position which I have the honour to hold, or of the confidence of the Court or of the public, if I had ever dreamed of applying one single mode of treatment over the whole area of the Metropolis, presenting, as that area does, such a variety of circumstances and features. I should have thought that any man who had made such a proposition, had fairly laid himself open to comparison with the medical pretender, who holds out his one specific for the cure of all disease. On the contrary, I must be allowed to say, that I have never made any statement which should lead to this conclusion, nor have I ever yet put forth any specific views with regard to the treatment of the general question of the drainage of the entire Metropolis. Amidst the host of local

circumstances attending the existing state of the sewerage, of which so little was known, and the varying features and levels of so diversified and extended an area, of which no trustworthy information existed, I fully coincided from the first in the general opinion which was then entertained, of the absolute necessity of the completion of the two great works of the surface and the subterranean surveys, before any consideration could be given to this large and important subject, at least with any prospect of a satisfactory result.

Every day's experience has so fully confirmed this view, that until the recent order of the Court, I can never have been said to have devoted a single hour to the subject, beyond the consideration of a principle, and the method of its application to the low districts; and so far from the assertion of a memorialist being correct, that I have for the last five years given my attention to it, it was on the 10th of this month only, that in compliance with the order of the Court, and having very imperfect information before me, I for the first time, and with reluctance, entered upon the consideration of the general question, so as to be enabled to lay down the comprehensive but imperfect view which I am now to present.

Whatever may be the most advisable principle for adoption, in considering the improvement of the drainage of the Metropolis as one great whole, it has appeared to me that the ground or area might be most judiciously divided into three portions, and that the treatment of each would differ materially from the rest.

*First.* The low and flat districts of the Surrey and Kent, and Westminster and Chelsea divisions.

*Secondly.* The densely covered hill-side grounds, and the raised flat surfaces or table land of the Northern side of the river, comprising the City of London, the upper part of the Westminster and Tower Hamlets, and the Holborn and Finsbury divisions.

*Thirdly.* The outlying towns and villages, such as Richmond, Highgate, Dulwich, Lewisham, or Greenwich.

From the actual position of the low and flat districts of the Surrey and Kent, and Westminster and Chelsea divisions, and the wretched state of the existing drainage in those divisions, it seemed evident that a completely new system of works must be entertained; and taking into consideration the uniform nature of the surface, I had little difficulty in presenting in evidence before the Sanitary Commission, the general character of the plan that I should propose for its improvement, which, being similar to that subsequently laid before the Court for the drainage of Westminster, I need here only refer to its leading features.

The system thus proposed for the low districts, consisted in the sub-division of the area into convenient parts, in each of which the refuse drains would converge to a centre point of outfall. These centre points, or sumps, would be connected with each other by syphons, or other means, and with an engine establishment at a distance; by which means the refuse drainage would be pumped up constantly without intermission, and either distributed over the country or discharged at a distance down the river. *Down River*

I am not prepared to say that this particular treatment would in all cases be the best even in the low districts. Various modifications by leading lines, and other arrangements by which intermediate sumps would be dispensed with, might in some instances be more convenient and economical; but these would be mere modifications. *Modifications*

The principle upon which that plan was founded,—namely, that of carrying the drainage to fixed points, and, in the case of a large town or area, the division of such area into districts for this purpose,—would remain; and I firmly believe it to be the best calculated to realise completely and economically, whatever may be the nature of the surface, the two great objects which should be kept in view, and to which all other points are subordinate; namely, the quickest removal of the refuse, and its readiest application to agriculture.

But the totally different circumstances which have to be dealt with in the other districts of the Metropolis,—the extensive hill sides and raised flat or table districts,—require, in order to realise the utmost improvement at the smallest cost, very different treatment to that pointed out for the low districts.

When the enormous extent, also, of existing sewerage works over these parts is considered, amounting to several hundred miles,—there being on one square mile *City of London* alone, comprising the City of London, some fifty miles of sewer, and scarcely a court or alley left unprovided,—it appears evident that, whatever method may be adopted for progressive improvement, and for a complete result in the end, the existing works cannot be overlooked, but must be made part of those means to that desirable end.

The chief point to be kept in view, both for efficiency and economy in these districts, is to prevent the refuse of the higher portions of the area from descending into the lower. For this purpose, the main feature of the plan proposed consists in a series of intercepting lines, at different ranges of altitude, cutting off the refuse in its descent and conveying it to fixed points of outfall in each division, from which, in the upper districts, it would distribute or discharge itself by gravitation, without the employment of artificial power. *Keeping the refuse from going down to be pumped up again*  
*Good*



These fixed points of outfall would not only assist and improve the present system, but would be the foundation for all subsequent improvement, by constituting the local points of discharge to which all future lines would tend.

*the Fleet* I propose that the lowest intercepting line for the range of hill side, immediately rising from the north bank of the river, should take the shortest and lowest practicable course. It would extend from Pall Mall to the Tower. It would have its inclination from each end, falling towards the valley of the Fleet lying between, along the course of which it would extend through the flat part of the confines of the City of London.

From this point, in order to save a separate engine establishment, particularly at a spot where it might be thought to be objectionable, the line should probably be tunnelled through the rising ground, still keeping in the course of the valley, to an engine station in the more open space in the St. Pancras division.

The other lines of intercepting drainage it would occupy far too much space to describe here.

*as to Rain Water* These intercepting lines and systems of refuse drains would be sufficiently capacious to convey not only the ordinary refuse from the houses in dry weather, but all ordinary rains falling on the external surfaces of streets, yards, &c., which at present convey an immense mass of filth into the sewers and the river.

For provision during storms, overflows would be provided from these drains into the existing sewers, through which the waters would take their course into the river only on those rare occasions.

The ordinary use of the present sewers, where they would be independent of the new systems, would be to carry off subsoil waters, together with clean waste waters from engines, manufacturing premises, &c.

The pumping establishments for the populated area of the Metropolis would be four in number: three on the north, and one on the south side of the river. For the western establishment I propose to adopt the present station of the Sewage Manure Company, where the work of distribution is already in action.

The central station would be in the open portion of St. Pancras parish, and the eastern station would be situated on the banks of the river Lea.

The Surrey and Kent central station would be in the open ground beyond Camberwell.

From these stations, pipes would be laid in all the most convenient directions for conveying the refuse away for distribution over the lands in the liquid state, or to unobjectionable places at a distance, for its manufacture into the solid state.

*Liquid  
& Solid  
Manure*

For the purpose of conveying it to sufficient distances at times when there would be no demand for its use, discharge lines of sewer would extend from the engine stations in an easterly direction; and the outlets would be sufficiently distant down the river to prevent the return tide from bringing any of the discharged refuse back into the Metropolis.

*Discharge  
Sewers*

These discharge lines would also serve as irrigation lines of sewer to the extensive marsh lands down the river.

It is proposed to adopt at these engine stations sufficient power to raise the whole of the refuse of the Metropolis in dry weather an average height of 100 feet above the surface, for the forcing and distribution of it towards various points for application to agriculture; and this same power would be adequate to raise it to the less height required for its discharge below the Metropolis, in addition to the ordinary refuse, and the immense body of filth now poured into the Thames during ordinary rains, thus protecting the river from constant pollution.

The advantage of the principle now proposed is, perhaps, even more striking in the treatment of the outlying towns and villages than in the dense and connected portions of the Metropolis. Their improvement would proceed with the utmost economy and efficiency, by their being taken separately and independently, according to the circumstances of each locality; and at the same time immediate relief would be afforded without having to wait for a general measure before their improvement could proceed.

For the relief of the low districts during floods, and their protection from the great damage at present caused during storms, I propose to construct lines of intercepting drainage for upland waters to relieve the Ranelagh and King's Scholar's-pond sewers, and the Fleet and Finsbury sewers, &c., on the north side; and the Effra and other lines of upland drainage, now descending into the low districts of the south side of the river.

*Low  
Districts  
in  
Flood*

(Signed)

HENRY AUSTIN,

Consulting Engineer,

Metropolitan Commission of Sewers.

25th August, 1849.

JOHN T. BARKLEY, Esq.

67, Mark Lane,  
23rd August, 1849.

*To the Commissioners of Sewers.*

My Lords and Gentlemen,

THE plan I have had the honour to propose, embraces the following objects :—

The separation of the land and surface drainage from the sullage of the inhabitants.

The conveyance of such foul division to the Thames at a point below the suburbs of the Metropolis.

The power of depressing the level of the general outfalls to any depth, necessary to induce an acceleration of current in the adjoining area.

A minute detail of the construction of main sewers, shafts, and reservoirs.

Such is a concise outline of the scheme of which I have presented the diagrams and estimate, in a form sufficiently detailed to enable you to decide upon its comparative merits.

I remain, my Lords and Gentlemen,  
Your very obedient Servant,

(Signed)

JOHN T. BARKLEY.

*Separation Land & Surface  
Drainage* } 3

GEORGE BURGE, Esq.

*The Right Honourable and Honourable Metropolitan Commissioners of Sewers.*

My Lords and Gentlemen,

THE scheme submitted by me, for the "*Sewage of the Metropolis*," and for the consideration of the Honourable Commissioners, consists of the following methods :—

1. Complete Drainage.
2. Complete Security.
3. Complete Purifying the Thames.

The drainage is secured by means of tunnels, placed as per plan or map delivered on the 20th of this month by me. The shape of the tunnels, nearly a SEMI-CIRCULAR, and the bottom paved, clear of sumpts, or cesspools, and with shafts, sluices, &c. &c.

The security of the tunnels is caused by the positions of the same, and the HEIGHT AND DEPTH; and further protected from pressure or overflow from back water, by PROPER MACHINERY.

The purifying the Thames is caused by the soil and soil water draining into the different reservoirs, as per plan.

The estimate can be reduced to meet the views of the Commissioners, if thought necessary, and further particulars given if required.

I am, my Lords and Gentlemen,

Your most obedient Servant,

(Signed)

GEORGE BURGE.

5, Shaftesbury Crescent, Pimlico.

## COMPETITOR, X. Y. Z.

### CENTIPEDAL DRAIN.

An intestinal tube, with tributary branches right and left, like the backbone of a fish, laid in a grooved channel, six feet beneath the bed of the river, following the course of the stream for any distance deemed desirable.

Its *advantages* are as follows :—

The execution of the work would interfere with no man's property, *being on City ground*. The tube to be of iron.

An entire independence of *ALL geological opinion!!* and a comparative independence of expensive surveys, levelling, &c. &c.; for, as all rivers adopt the lowest level of the district through which they run, on their draining course, formed on the *unerring principles of nature's silent engineering*, so will their level be the lowest to which all others *must* incline, subservient in tributary fealty; a sovereign example the Board of Ordnance may copy, but never surpass.

A total avoidance of all land-drains and irruptions from invading waters, which a tunnel would be liable to meet in ambush! and *no preliminary feeling of the way*, by boring, necessary!



The common river dredging machines would excavate the grooved channels for the tubes at little cost, and the raised soil would be immediately sold as ballast. From the branch pipes, stretched right and left to each shore, a net-work of veins might spread their fibrous ramifications through the entire body of London.

All storm water could be turned aside by shutting a trap provided at each branch.

A contrivance at each terminating reservoir, for applying a vacuum, would prevent the liability of any stoppage or constipation in the tube.

Lastly, the tube being *from draughts inviolate*; moreover, its being *perpetually condensed by the Thames, all eructation back on the Metropolis would be stopped*, everything being *compelled* to move in one direction; the tube being, in fact, the *Colon* of the City.

(Signed)

X. Y. Z., COMPETITOR.

*To the Honourable Commissioners of Metropolitan Sewers.*

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JOHN HENRY CLIVE, Esq.

Clanway Colliery,  
Tunstall, Staffordshire.

THE object of my plan is,—first, to separate the surface waters and rain floodings from the night-soil and liquid refuse of houses and places of business; next, to allow such surface waters to flow into the Thames, by means of the channels in a great part already provided, and to remove the night-soil and liquid refuse from the streets and houses as fast as it arises; and lastly, to keep dry the foundations or subsoil, and immediately to apply the collected sewage to profitable purposes, in portions as it accumulates, without forming one grand depôt of the whole.

The means I take to effect these several objects in the most economical manner, are the following:—

To construct two grand underground channels, impermeable, made of vitreous bricks set in cement, one on each side the river Thames, to receive the contents of all tributary drains, which channels are to commence about Twickenham and Richmond, and terminate, or tail out, *above high water mark*, at or below Plaistow

*Tunnels one on each side of Thames*



and Plumstead Marshes, as the levels by the Ordnance survey may be found most suitable.

The dimensions of these channels to be of an average size, reckoned from a consideration of the whole sewage, the probable quantity intercepted, and sent into the country, and that which at first may not be so disposed of, but must run waste into the lower river or sea. This average size I take as sufficient at about four feet diameter for each channel at the influx, and five or five and one half feet diameter at the outlet; and I reckon the expense of each channel at not exceeding £11,000. per mile, including shafts, inlets, outlets, and stations. *Singh Tunnel*

In order to cause a current, these main channels are to have an ascent from the outlet of about two and a-half feet per mile, with suitable openings for receiving and extracting the sewage, ventilation, cleansing away deposits, and for repairs.

These grand channels I would cause to run as near to the Thames as the before named levels, ascent, and the foundations of buildings will permit. All drainage from above, or on higher levels than these main channels, I would cause to flow into them by the current of gravity; and all drainage from lower levels than these main channels I would collect from districts *on the converging system, recommended by Mr. Austin*, in February, 1848, and raise the same by engine power into these main channels.

Mr. Austin states the expense to be about £50. per acre, exclusive of engine power, and I estimate that about 200 horse-power will raise all the lower ground drainage, at a cost of less than £4,000 a-year; but this cannot be well determined, until reference be had to the levels in the Ordnance survey.

These grand channels being thus prepared to receive at intervals along their line all the drainage of the Metropolis, I would establish a number of stations, not fewer than six, where the sewage might, by contracting parties, be extracted as it came, and sent into the country for agricultural purposes: one such station is already founded at Fulham by the Metropolitan Sewage Manure Company, and is in successful operation.

I reckon that, ultimately, most of the sewage will be contracted for, there being no doubt of its fertilizing powers, and that little will have to run waste into the lower river.

I estimate that it will require 1,200 horse-power to force the whole of the sewage in a liquid form into the country, and in consideration of the surface waters being kept out of the grand channels, and stations and facilities (not engine

power) being provided, I would charge for the sewage a progressive rent up to £100. per horse-power per annum, equal to about one halfpenny per ton, producing to the Commissioners a clear rental of £100,000. a-year, exclusive of the Metropolitan Sewage Manure Company, who by Act of Parliament have the sewage of their district free.

I recommend, in an undertaking so highly beneficial to posterity, the adoption of *the best principle, without regard to expense in the first instance*, and then to carry out that principle in the most economical manner, consistent with durable efficiency.

(Signed)

JOHN HENRY CLIVE.

22nd August, 1849.

*No Tunnels*

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FRANKLIN COXWORTHY, Esq.

THE gases generated in sewers may be divided into two classes, those lighter, and those, naturally, heavier than atmospheric air; but in consequence of their negative electrical condition, when generated, they all have an ascending influence, and collect in the upper part of the sewer, where they now make their escape into the atmosphere and buildings, producing most injurious, if not fatal, influences on the community at large.

As a remedy for this evil, I propose the use of shafts and metal tubes, as shown in the accompanying drawings, to be connected with the upper part of the sewer, so as to afford, at all times, a ready escape for the light gases above the tops of the houses or highest inhabited buildings; and in order to impart to the heavy gases, which are the most pernicious to health, their natural specific gravity, I adapt to such shafts and tubes electrical points, by which constantly to draw down from the upper regions streams of electricity, which fluid, recent discoveries in science have shown, imparts to matter a gravitating influence, and must therefore cause their re-descent into the sewer, where they will act as precipitants to numerous salts, held in solution by sewer water, which otherwise would be lost, and will also tend to throw the atmosphere of the sewer itself into a positively electric or healthy state.

To prevent the pollution of the river, into which the sewers *naturally* discharge, and to collect, for agricultural purposes, the valuable matter that now runs to waste, I propose to construct in the DISCHARGING sewers (which must be made sufficiently numerous and capacious to prevent, in ordinary rains, any rush of water through them) dams or pits, as the locality may render advisable, as collectors of the filth, a practice that has long been successfully applied, the water being turned from one set of dams or pits into another set as they alternately become full of matter.

To facilitate the removal of the soil when the collecting chambers require emptying, and as deodorisers, I propose mixing with it a little quick lime, or peat charcoal, which will enhance the already high fertilising properties of the manure, and to run across the transverse walls of the dams or pits, as shewn on plan, a rail, on which shall travel trucks, to be filled in the ordinary way, and then to be propelled to the mouth of the sewer, where the matter may be discharged into barges.

Whatever plan of drainage may be adopted, it is evident that it must be ineffectual *as a sanitary measure*, unless a proper system of ventilation be attached to it; and the necessity for this must increase with the increase of sewage surface, the gases obviously travelling in a contrary direction to the water; the only expense, therefore, which these suggestions can entail, as regards drainage, will consist in building the discharging sewers (to be about a quarter or half of a mile long) a little larger than they otherwise would be constructed; in erecting cross walls, or sinking pits in them; and in the construction of a slight rail, no alteration whatever being contemplated in the present system; all of which arrangements have for their object, to facilitate the collection and removal of the filth, and must, therefore, tend greatly to decrease the necessity of manual labour in the sewers.

Whether or not the necessity of applying stink traps to gully-holes will any longer exist, when the system of ventilation I have proposed shall have been carried out, it would be hazardous to affirm; but I suspect that the upward current in the shafts will cause a constant flow of air down the gully holes and house drains, and if so, these impediments may be removed: and I think it must be self-evident, that as the shocks to which the human frame is subject, and which have such a distressing influence on some constitutions before rain, and especially before and during thunderstorms, are referable to the passage of electricity through the system, any means by which the stream can be diverted, will tend to the improvement of health; and this the electrical points will do most effectually; the sewer, be it observed, where putrefaction is taking place, being one pole of the battery, and the clouds, where matter is forming, the other; the connection between which, electrically, by my arrangement, will be established above the atmosphere in which we move.

A shaft sixty feet high, nine feet at base, and six feet at the summit, may be erected for £150.

Westminster-road, 24th August, 1849.

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J. W. COUCHMAN, Esq.

Durham-place, Lee, Kent,  
14th August, 1849.

*To the Metropolitan Commissioners of Sewers.*

Gentlemen,

IN laying before you my suggestion for a new system of draining the Metropolis, I have not pretended to any thing more than a general outline of the plan; and of which the only portions I consider as fixed (either as regards directions or dimensions), are the surplus outlet sewer and terminus shafts, (marked yellow on map), engines, and houses at Eastern termini, and iron discharge mains (marked brown on map), the cost of which I have given, and which I believe will be found to be as correct as they severally can be estimated at. But I must here remark, the cost for the surplus outlet sewer is estimated for under the impression of tunnelling with my shield (a model of which I have submitted to you). The red marks on the map have reference to supposed route of principal reception sewers.

I will now proceed to the explanation of the system I propose.

1st. Let the existing sewers remain as at present (excepting repairs and trifling alterations, where necessary, in their fall), for the purpose of conveying off the water from the streets, tops of houses, factories, yards, and also sinks in houses, excepting all places where any considerable quantity of matter fit for agricultural purposes is constantly being discharged with the water.

2nd. Construct new sewers of dimensions varying according to the districts that would be drained into them severally as main lines, the courses of which would be determined by the different levels, keeping the lines of the low parts, and so that the lowest might be drained: to have a fall into the common channel of outlet of their particular side of the Thames.

3rd. The various streets to have drain pipes, of glazed stone ware, passing down them, varying in size according to the position of the streets as regards level relatively to each other, and the quantity probably sent into them; these again to empty themselves into main lines of pipe of increased dimensions, which would, in their turn, form junctions with their district reception sewers.

The increase of population will have its due influence in the calculation for the size of certain of these sewers above named.

4th. Construct surplus outlet sewers, by tunnelling in the directions as nearly as possible of yellow lines shown on map, and which would pass along convenient routes for the drainage of London and environs, and at the same time be in the neighbourhood of the districts where the manure would be required; and wherever it would be most convenient, a shaft might be sunk to the tunnel, an engine erected, and the process of irrigation carried on; but in some places the junction shafts would also form supply shafts. The depth of these outlet sewers would depend on the lowest sewers that would discharge themselves into them on their particular side of the river; and also that, in rising from their lowest point, they might still avoid, towards their western termini, coming in contact with any artificial obstacles, such as existing sewers, water mains, canals, &c. The section on map will show about the depth it will be necessary to begin at eastern termini to admit of a fall from all parts into the outlet sewers, as well as to avoid all obstacles before mentioned; but it may be necessary to go yet deeper. The size shown in section is sufficient both for the present and the additional quantity that will have to pass through it as time goes on, requiring only increased power of machinery to raise it as the quantity of liquid materially increased; for I propose this sewer should remain always full, as well as the junction shafts, to the height of lowest reception sewer, which would also diminish the depth for the pumps. At the junction shafts air chimneys must be erected, among other objects, to obtain the pressure of the atmosphere in its full force; and in the reception sewers flood-valves would be placed as close as possible to the junctions, so that if it were ever necessary to traverse the outlet sewers, the communication with those that discharged the greatest quantity into them might be cut off, and the liquid exhausted for the time, so that with the fall of two feet in a mile the remainder still falling into them might flow to the pumps.

I propose the matter drained by these sewers should consist of night-soil and urine, the drainings of stables, slaughter-houses, and the like places, and which, with the water used for flushing the closets and cleansing the other places, would, in the body, be scarcely less elastic than water, and would probably amount to 2,000,000 cubic feet in each twenty-four hours; and this quantity being so vast in its magnitude, it would require the consumption of many thousand acres even to make a visible effect upon it; and as the expense of consolidating it would most probably be greater than the value of the manure, or the means of reserving it in its liquid form for an unlimited time be almost impracticable, requiring tanks of the aggregate dimensions nearly equal to  $1\frac{1}{4}$  miles square, and 8 feet deep (covered of course), for the accumulation of one month. I would raise it at points where the engine-houses are shown on the map, and force what was not used for irrigation in the direction of the brown lines, at eastern termini, to the river, as shown, below Woolwich, from whence it would be carried, at every ebbing of the tide, to the sea.

5th. The pipes through which the liquid would be forced to be iron mains of two feet diameter, bent at the ends next the river, so as to discharge themselves at all heights of the tide, having brick receivers at their outlets, so as to avoid the washing away of the banks at low water.

6th. I would raise the liquid by steam engines. Taking the daily fall from the Metropolis and its environs, of the last mentioned matter, at the aforesaid quantity of 2,000,000 of cubic feet, it would require the power of 800 horse, to raise it 30 feet high (sufficient for a constant discharge into the Thames in the system I propose), and also to raise a portion of it 200 feet higher, for the purpose of irrigating the surrounding high country, in the given time of 24 hours; which power would allow of the quantity stated being exceeded either from its irregular passage, or the gradually increasing quantity, for at least 500,000 cubic feet more; and I should recommend this power at eastern termini, independent of small engines to be erected at the same time at western termini, to supply the market gardens which there abound.

It will be seen I have not drawn a red mark through Brentford, to communicate with the outlet sewer; but as there are other towns beyond, and a large district of garden and farming ground, the quantity of matter those towns produce, may be found to be no more than will admit of being accumulated in tanks, conveniently placed, into which their reception sewers might fall, for the convenience of those grounds, and contain the surplus from time to time; but on the other hand, the fall may be reversed, and they may fall into the line of another sewer, which empties itself into the outlet sewer. These last remarks will also apply to the opposite side of the river.

The subjoined items are the calculations I have made of those portions mentioned in the preface, with the addition of the receivers at outlets of iron main. The other portions of the scheme will require a special survey for the purpose, to determine the lines of the reception sewers, and also the assistance of papers to which I have no means of access; but I may safely affirm the cost for the other works will so far exceed the aggregate of the subjoined items, as to make it completely insignificant.

Surplus outlet sewers, 3 feet 6 inch  $\times$  3 feet 9 inch, worked with shield.

North side, 12 miles 4 furlongs

South side, 11    „    0    „

23   „   4            at £4,394 per mile ..... £103,259

Shafts at 4 termini, averaging in depth, 38 feet 6 inch, 3 feet } 146  
diameter in 9 inch .....

Carried forward..... £103,405



Brought forward .. .. .				£103,405	
North side iron main, 2 feet diameter,— 2 miles 4 furlongs 110 yards					
South side, 1	„	1	„	0	„
3	„	5	„	110	
				at £5,252 per mile,	
				laying complete }	19,366
Two engine houses at eastern termini, <i>supposing</i> each had the				same weight of machinery, at £5,250 each .. . . .	10,500
Engines of the aggregate of 800 horse, at £38 per horse,				complete with stand, pipes, and fixed .. . . .	30,400
Receivers at outlets of iron main, at £70 each .. . . .					140
					<u>£163,811</u>

The sewers, and all brickwork in contact with the sewage matter, to be constructed of well burnt black stocks and blue lias lime.

(Signed)

J. W. COUCHMAN.

MATTHIAS DUNN, Esq.

Newcastle-on-Tyne, 21st Aug. 1849.

*To the Secretary of the Metropolitan Commissioners of Sewers.*

Sir,

HAVING perused the resolutions come to yesterday by the Board, I beg to inform you that the leading features of my plan, dated the 23d July, for which I had your acknowledgment, consists as follows:—

1st. A shaft to be sunk at the highest surface level of each district of the Metropolis, to below the level of the River Thames.

2nd. Upon the top of this shaft a powerful engine to be erected, for the purpose of raising water to be poured upon the streets, or into the main sewers.

3rd. This water to be brought from the Thames by means of a tunnel communicating the river with the said engine-shaft.

4th. The water once delivered into the sewers at the highest level, to be guided from point to point by means of plank doors.

5th. The engine boilers to draw their air from the main sewers, the effect of which will be, to induce the atmosphere to enter at the gratings and sewer mouths, and ascend the chimney, which would form a most natural and powerful ventilating process.

6th. The advantages would be—a very moderate and calculable cost, and an application of the present sewers, instead of waiting for new schemes with very questionable results. The annexed profile exhibits the nature of my plan.

NOTE.—An unlimited supply of water would always remain at the bottom of the engine-shaft.

	(Signed)	MATT <sup>s</sup> . DUNN,
Newcastle-on-Tyne.		Mining Engineer.

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RICHARD DOVER, Esq.

28, New-street, Spring Gardens,  
August 24, 1849.

E. H. WOOLRYCH, Esq., *Secretary of the Metropolitan Commission of Sewers.*

Sir,

I BEG to acknowledge the receipt, yesterday, of your notice of 22nd inst., and, in compliance therewith, subjoin the “concise statement” you request; first observing that, “by Her Majesty’s Commission of 24th September, Commissioners were appointed to inquire whether any, and *what special means may be requisite for the improvement of the Health of the Metropolis;*” and that said Commissioners, on the 19th November, 1847, stated, “The first subject taken into consideration was the reported progress of the Asiatic Cholera towards Europe, and the probability of its again visiting these islands!”

The “main features” in my prospectus of the 18th current, are—

The immediate preferment of the public health by neutralizing, if not annihilating, the cholera; and preventing its becoming endemic as well as epidemic!

The immediate means of enabling a *better* drainage of London, by lowering the exits of the sewers!

The immediate means of preventing “the sewage of Clapham running through Battersea, or into the Thames!”

The immediate purification of the Thames by *preventing the discharge of any sewage* into it!—especially as “many in London are forced to have compounded in their food, to their deadly injury, its waters daily, polluted, as they now are, with more than a hundred thousand tons of pestilential filth.”

To produce immediately a very large revenue to Government, and more than sufficient, in my opinion, to sewer and water London *WITHOUT tax, rate, or charge!*—and further, by judicious treatment of said “sewage,” produce a cheap, portable, very fertilizing, and inodorous guano to national, as well as individual profit and sanitary benefit!

I have the honour to be, Sir,

Your very obedient servant,

(Signed)

RICHARD DOVER.

ALEX. DOULL, Esq., C.E.

*To the Right Honourable and Honourable the Metropolitan Commissioners of Sewers.*

1st. That nothing effectual can be done towards an economical and efficient drainage of the metropolitan district, without an accurate survey and map, with the necessary levels: such map also to exhibit all the existing sewers and works, with the levels of each.

2nd. The whole natural drainage area to be placed under one jurisdiction, and treated as a whole.

3rd. The Thames being the natural outfall for the whole of the London basin, to remain so, as far as to carry off the surface water.

4th. To separate the artificial or house drainage from the surface or natural drainage. This operation to be confined, as much as possible, to the existing sewers, *separation of drainage* so as not to disturb the thoroughfares.

5th. An outfall sewer to be constructed for that part of the metropolitan district south of the Thames commencing near Wandsworth, and passing near to Nine Elms, through Newington, Bermondsey, the lower part of Deptford and Greenwich, and also through part of Woolwich, to Plumstead Marshes.

6th. This leading outfall sewer to be kept as near the surface as possible, and to vary in size, according to the quantity of matter to be carried off, probably from two feet to six feet diameter.



7th. At the salient angle of the river in Plumstead Marshes several water-wheels to be erected, and to be worked by the flow and ebb of the tides. The mechanical power thus obtained to be employed in pumping the sewage water from the outfall sewer.

8th. The sewage would, in the first instance, be pumped into large reservoirs, which would be used alternately; and from these reservoirs the liquid manure to be distributed, by pipes, over the neighbouring lands, or by land or water carriages to the more distant places. Barges, or floating tanks, hermetically sealed, may be employed for conveying the liquid manure to the various creeks and inlets of the Thames and Medway, and distributed over the fields in properly constructed carts.

9th. As much of the sewage as can be disposed of in the market gardens along the course of the sewer to be pumped out by hand-labour, or otherwise, for that purpose.

10th. That the point for the final disposal of the sewage be so placed that, should the demand for it fall short of the supply, the surplus can be thrown into the Thames during the ebb tide, so as not to return towards the Metropolis.

11th. The same general principle to be adopted on the north of the Thames as that already described as applicable to the south side of the river, so far at least as the varying circumstances may permit.

12th. On the north side of the Thames a pipe drain or sewer for the disposal of the artificial sewage to commence west of Battersea-bridge, to pass through Chelsea, near to the north end of Vauxhall-bridge, between the Penitentiary and the River, along Millbank and Abingdon-streets, through New Palace-yard, and along the foot of the wharf wall in front of Whitehall-gardens, to a point between the Suspension and Waterloo Bridges.

13th. That, as a general principle, no natural or artificial drainage or sewage be permitted to flow into a tide-bound district, such as Westminster. Sewers will therefore be constructed at the lowest point of the rising ground to the north of the low district of Westminster, so as to relieve that district of the greatest possible quantity of extraneous matter now flowing into it from the upland districts. The sewers constructed for the above purpose would convey the natural drainage, and also the artificial sewage, but in separate compartments, to the point above described, between the Suspension and Waterloo Bridges. The surface drainage flowing into the river, and the sewage uniting with the pipe, as above described, conveying the artificial sewage from the Westminster district.

14th. From the above junction a sewer or cast-iron pipe, of increased dimensions, to be carried along the bank of the Thames, between high and low water, as far, if possible, as London-bridge, receiving the artificial sewage as it passes along the several points of discharge. From London-bridge the outfall sewer to pass to the north of the Tower, along Ratcliff Highway, through Limehouse, north of the East India Docks, under the River Lea, and along the Essex Marshes, to the bank of the Thames, near Barking Creek.

15th. Auxiliary drains to be constructed, if necessary, commencing near Islington, and passing through Bethnal-green and Bromley, and falling into the main outfall sewer near the River Lea.

(Signed)

ALEX. DOULL, C.E.

1, Morden-terrace, Greenwich,  
24th August, 1849.

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### MESSRS. DREDGE AND STEPHENSON.

THE main features of this plan are comprised under the following heads :—

1st. The construction of a main sewer of iron or brick, from Brentford on the west to the Plaistow Marshes on the east, which is to be divided into sections, each having a sufficient inclination to generate a stated velocity, this inclination being obtained by lifts at certain stations, where the sewage will be pumped up by steam-power in a closed shaft, from one section into the next.

The course of this drain will be across the Fulham fields to Battersea Bridge, it will then follow the river line\* to the Isle of Dogs, which it will cross, to the north of the West India Docks, and enter the Plaistow level, where the final reservoir will be placed, its section increasing as it proceeds.

2nd. The concentration of the outlets of the present sewers, so as to cause the sewage to enter the proposed plan in fewer places.

3rd. The separation of the sewage from the surface waters, by placing, where practicable, within the large sewers, a smaller tubular pipe to intercept the sewage; and, where not practicable, constructing a new pipe for this purpose, appropriating the old one entirely for surface drainage. *Separate at Plaistow*

4th. Collecting the whole of the sewage in the Plaistow Marshes, and using it for agricultural purposes, either in a solid or a fluid state.

(Signed)

DREDGE & STEPHENSON.

10, Norfolk-street, Strand.

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\* The sewer to be carried either in front or at the back of the river wall, as may be found most convenient.

## JAMES DEAN, Esq.

THE substance of a Report delivered to the Metropolitan Commissioners of Sewers, on the 20th of August, 1849, by James Dean, of Tottenham, referring to two maps; the first made to a scale of three inches to a mile, embracing London and its environs, extending from Putney to Plumstead-on-the-Thames, and shewing the general direction of two lines of main sewers, proposed to be made on each side of the river respectively; one commencing on the north side, opposite to Wandsworth, and terminating in the marshes at East Ham, opposite to Woolwich, and the other commencing in Battersea-park, and ending in Plumstead Marshes, below Woolwich.

2 *Sewers*

The second map, to a larger scale, shows the line of an embankment on the north side of the river, proposed to be made with the spoil earth, to be excavated from the said main sewers, between the Houses of Parliament and Blackfriars-bridge.

In the Report it is assumed that all great rivers owe their origin to rents in the earth's surface, occasioned by some convulsion of nature, and as the depths of these rents or fissures must, obviously, be uncertain, it would not, therefore, be safe to traverse them; hence the impolicy of expending large sums in attempting to make one great sewer to cross and recross the line of the river Thames, and then the sewage to be lifted at the terminus, and distributed by steam power in the direction of demand, for agricultural and horticultural production. It is assumed, also, that the forming of dépôts or sumps, to receive the sewage on the lines of the existing sewers, and removing the sewage thence by means of steam-power, hose, covered carts, &c., to a distance from London, to promote agricultural and horticultural production, is too hypothetical to claim serious attention; and having, as I conceive, disposed of those fallacies, I proceed to state what, in my judgment, should govern the great question at issue. There can be no mistake, in assisting the natural drainage of the districts in question, by a slight diversion of the sewage from the course of the existing sewers, to accomplish which, I propose to adopt as data the Trinity high-water mark at Woolwich, and at Wandsworth, and to commence a main sewer on the north side of the Thames, opposite to Wandsworth, where I propose to excavate a flushing pond of twenty acres, to be fed from the Thames at high-water, the water in the pond to be retained by a penstock or sluice, placed at the mouth of the proposed sewer. The sewer to be circular, and four feet in diameter at its commencement, and formed with sound bricks, stone, mortar, and cement, its depth from the high-water line at its commencement, to the apex of the arch, to be seven feet. The course of the sewer to be governed by the rise of the ground from the river, northward, so as generally to be about fifteen feet below the surface. The sewer to be continued in an easterly direction to the marshes in East



Ham parish. The sewer to be the frustrum of a cone, eight feet in diameter at the lower end, with a settling pond of sixty acres at its termination. The pond to be in two divisions, with a canal for barges within the division, communicating with the river Thames. At the two ends of each division sluices to be placed, those at the end next to the mouth of the sewer to turn the sewage into either division; those at the end next to the river to let the limpid portion of the sewage into the canal, and thence into the river, or to pass the same into cylinders or open channels to irrigate the surrounding and distant marshes. The sewer will be about twelve miles in length, and is proposed to fall in its whole length four feet, and as the tide at Woolwich rises twenty feet, there would remain a fall of one foot from the outlet canal into the river. That portion of the canal which will be in the division between the two portions of the settling pond is proposed to have stop-gates, so as to form a lock, to retain the barges whilst loading with the solid portion of the sewage. The settling pond being excavated five feet below low water-mark, to retain the solid portion of the sewage; the flushing pond at the upper end of the sewer also to be excavated five feet below the bottom of the sewer, to retain water for ornamental or other purposes. All the existing sewers that are above or cross the line of the proposed main sewer will communicate their contents into the main sewer by means of pipes or shafts; those (if any) that are on a level, will also communicate their contents into the main sewer. At such junctions the apex of the main sewer will have circular apertures, covered so as to continue the overflow during storms of rain, or thaws in winter, in their accustomed course to the river.

A sewer so constructed, with a regular fall, and the bottom made even throughout, with a flushing pond at the upper end, and settling pond at the lower end, would operate thus:—the flushing pond of twenty acres would fill at high water of the tide, so as to be from eight to eleven feet deep above the bottom of the sewer. When the tide became near to the ebb at Woolwich, the sluice would be drawn, when the weight of so large a quantity of water, with so considerable a fall, the impetus could not fail to force forward the sewage to the settling pond, and being repeated at every ebb of the tide, would insure the thorough cleansing of the tributary as well as main sewer. Branch sewers to the main sewer would be required, to take the sewage from the houses &c. between the river and main sewer. At about half a mile distance from each other conical chimnies would have to be formed on the top of the main sewer, to convey the foul air emanating from the sewage above the surrounding houses.

The sewer and ponds proposed to be made on the south side of the river would not require to be more than half the size of those last described, in other respects the formation, levels, &c. would be the same, and need not therefore be re-stated.

The spoil-earth from the main sewers might be most fitly applied towards the embanking of the north side of the Thames, as before described, and should not be lost sight of.

Any estimate of the cost of the works to carry out the proposed plan would be mere guess work. When the Ordnance survey, with contour lines or bench marks upon the plan, has been completed and published, then might an estimate be formed with some degree of accuracy, though not then without much labour and care.

(Signed)

JAMES DEAN.

24th August, 1849.

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RICHARD DIXON, Esq.

*To the Commissioners of the Metropolitan Sewers.*

My Lords and Gentlemen,

IN accordance with the resolution of your Court, held on the 20th instant, I beg to forward a concise statement of the main features of my plan for disposing of the sewerage of the Metropolis.

It is proposed to let the present watercourses, drains, and sewers take off the surface water, only arising from rains and springs; and to lay down independent sewers to carry off the refuse from waterclosets, and all foul water from houses, manufactories, and hospitals.

To stop up all communication between the present drains and foul waters, suffering such to pass away only through new sewers laid down for that purpose, and not to permit any communication with sewers till it be ascertained that an ample supply of water has been provided to carry off all refuse. The whole of the area under the Commission to be divided into districts, and in each district the sewers to converge to one common receptacle, sufficiently large to contain all the sewage of each district, to be provided with all the apparatus necessary for the reception, disinfecting, and sale of manure, when there is a sale for such manure; or when there is no immediate demand for it, or on account of the state of the weather or disease there is a necessity for an immediate discharge of same, to pass the sewage through an artesian well of absorption provided in each district for that purpose.

These wells have been used for the last few years at the Hospital de Bicêtre, at Paris; and by several experiments made by Le Seigneur Mulot and H. E. Emmery, Engineer in Chief of Roads and Bridges, to discover whether these artesian wells were applicable to carry off the sewage of Montfaucon, it was ascertained that at the Barrier du Combat there were artesian wells that could absorb above a thousand cube feet of liquid per hour, and that such wells might be kept distinct from sheets of water supplying artesian wells for industrious or household purposes. — and to

*spoil the water*

By this plan each suburb of London has the produce of the sewage to fertilize the land adjoining. Such produce it is supposed will yield a fair interest for the necessary outlay.

I have the honour to be,

My Lords and Gentlemen,

Godalming,  
25th August, 1849.

Your very obedient Servant,  
(Signed) RICHARD DIXON.

JOHN ELLIOTT, Esq.

18, Portland-terrace, Southampton,  
and Holland, Chichester,  
August 23rd, 1849.

*To the Honourable the Sewers Commissioners.*

My Lords and Gentlemen,

THE project for the drainage of the Metropolis which, on the 11th of July last (being some days previous to the issuing of your invitation to competitors to send in designs) I had the honour of submitting for your consideration, and which you were pleased to acknowledge by a vote of thanks, a project equally applicable to the case of all towns possessing the advantage of water-carriage,—embraces the following points:—that the existing sewers are all to be made available to conduct the whole drainage to the banks of the Thames, but not to enter its waters, to prevent the contamination of which, the choking up of the bed of the river, and the loss of so much valuable manure, at the outfalls or near to them, of the great sewers (connecting with these, by a lateral tube, following the river bank, all intermediate minor sewers), works similar in principle to those exhibited in the plans submitted, consisting of filtering channels and sumps, with a stationary steam-engine over them, shall be constructed, by which the sewage matter would be thoroughly filtered, the clear water obtained discharged into the Thames, partly during the ebb of the tide by a sluice-gate, at other times by the engine, and the solid residuum conducted, by aid of the machinery connected with the steam-engine, into sumps of sufficient capacity, from which it will be pumped up, through a large hose, into vessels constructed with air-tight compartments, and by these vessels conveyed down the river to the various depôts on the banks, or adjacent coasts, or wherever a demand for such manure may arise: during the passage down the river, the engine on board working the paddles, employing itself also in thoroughly incorporating the deoderising substances with the manure, and in discharging that when arrived at its destination.

The filtering channels connecting the sewers with the sumps are, together with the latter, to be vaulted over, so that no escape of foul air from these works, or the



vessels, is to be permitted, except into the ventilating shafts which, of considerable altitude, are to be erected over the termini of the selected main sewers; such shafts serving also as chimnies for the engine, the steam and hot air from which would always cause a considerable amount of ventilation, to be increased at pleasure, by blowing off the steam into them, or by constantly keeping up a fire in the bottom of such shafts, and thus consuming the foul air from the sewers.

For the effectual relief of those low level districts lying adjacent to the river, on its banks similar works, consisting of sumps and filtering channels, to be constructed sufficiently deep to receive such drainage; the engines at these stations having therefore a few feet greater lift to discharge the contents of the sumps into the manure vessels.

In those low level districts at too great a distance from the river to take the drains direct to it, in convenient spots, vaulted sumps to be sunk at the required depth, and the contents, so fast as they accumulate, raised and discharged by small stationary engines into one of the existing lines of main sewers. As there is to be no opening from these sumps, except into the sewers, no nuisance to the neighbourhood could possibly arise.

For the purpose of effectually flushing the sewers, reservoirs in convenient localities to be constructed, and a sufficient extent of surface drains laid down to take the rain-water into these reservoirs, which are to be of such capacity as to admit of the requisite quantity of water being, at twelve o'clock at night, simultaneously throughout the Metropolis discharged from them into the sewers; and by carefully trapping all the gully-holes and inlets with the description of trap submitted, all the foul air during such flushing would be forced up the ventilating shafts.

The new works and sewers required to be constructed with the large radiated clay tubes, invented by me for such and other purposes, and specimens of which, made at the tile works of his Grace the Duke of Richmond, to try, at his Grace's expense, an experiment in constructing cottages wholly with such tubes, were by me submitted to the Board of Health, and the great economy to be effected by their use in the construction of sewers, pointed out, two years since.

The peculiar advantages of my plan are: that the manure vessels afford the means of commanding a most extensive range of markets, admit of the formation of any number of depôts, *before* deposit in which the manure is deoderised, and the danger obviated of producing a perpetual malaria for miles around the neighbourhood of any great sewer depôt: that each set of the river sumps and filtering channels being independent of the others, and none of the sewage being taken to a depth greater than is abso-

lutely necessary, a far less amount of mechanical power is required to raise such sewage than when this point is neglected; and the superfluous water being got rid of at the outfalls of the sewers, no expense for carriage is incurred, except for that which is of value: that the storm waters, by means of a sluice-gate in the outfalls of the main sewers, could be allowed to flow into the river, when accumulating faster than the engine could discharge them: that the discharge from the sewers would be continually kept up, and the contents never pent up in them; while in case of accident to the engine, the sluice-gate would afford the means of letting off the sewage, as at present, into the Thames,—certainly a far less evil than to stop, or even check for twenty-four hours the drainage of London: that no preliminary borings, and very few levels are required; that there is no uncertainty about its practicability; no natural obstacles to overcome; no local peculiarities to which, without the slightest interference with the principle of the scheme, it would not accommodate itself: that it can be tried as a perfect system at any one point, or the whole works necessary in the river be completed in six months; while the annual profit from the manure obtained would greatly exceed the whole original outlay.

It rests with the Board to decide whether any other scheme can be devised which, thus providing for the discharge of storm waters, effectually ventilating and flushing the sewers, draining thoroughly the low level districts, providing for the continued discharge of the sewage at all times of the tide, securing the whole of the valuable portion of the sewage, and preserving the atmosphere and the river from pollution, can, in comparison with the means submitted, effect all these objects with equal or greater simplicity, economy, and efficiency.

I have the honour to be,

My Lords, and Gentlemen,

Your most obedient servant,

(Signed)

JOHN ELLIOTT,

Architect and Civil Engineer.

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CHARLES FOWLER, Esq.

August 20, 1849.

THE statement accompanying the plan recites the existing evils, their causes, and the means to be adopted for removing or remedying them, especially that they should be of a practical and feasible nature.

It then proceeds to describe the plan, the main features of which are, the carrying off the whole of the drainage of the Metropolis into the country, and applying the fluid to fertilize the land; to effect which it is intended to collect into wells the water of the sewers near their outfalls, by intercepting them, by tunnelling, or by conduit pipes, according to circumstances; to erect engine stations, and pump

off all the fluid into the surrounding country, through main pipes diverging in every direction, and passing along the principal thoroughfares and railroads. The distribution through branches and service pipes to form a distinct portion of the undertaking, and to be effected by separate means.

The entire system will be analogous to that of the reciprocating action of veins and arteries in the human body, the water being first pumped into the town for the use of the inhabitants, and then pumped back into the country charged with fertilizing matter to promote vegetation, thus carrying out the proper course of nature, by the continual reproduction of organic matter.

The plan is so framed as to be worked out progressively in successive portions, and thus to profit by experience.

To commence with the *Fleet river*, which section has been calculated in detail as to outlay and results, upon which a general computation has been formed for the whole Metropolis, and the circle or area of country which the supply will embrace.

In regard to *finance*, it is proposed that the Commissioners should undertake the whole of "*the plant*" to the extent of the main pipes; the remainder, or distributive portion, as well as the "*working*," to be carried out by separate local companies, under a general Act of Parliament, thus having an uniform base of operations, and under the general control of the Commissioners.

The companies to receive the rates from the agriculturists, and to pay the Commissioners a rent, or share of profits, in proportion to their outlay on the plant, upon the principle of mutual benefit.

Among the prominent advantages of this plan may be mentioned,—

Its *practicability* as being applicable to the existing sewers, and not requiring any general re-construction.

Its *economy*, partly for the reason last-mentioned, and that the required works will be of a moderate and limited extent.

Its *non-interference* with property and convenience, public or private.

Its freedom from heavy risk, as it may be carried out in sections, profiting by experience in each case successively.

Its combining commercial enterprise with public benefit, which, as now proposed, will be the means of providing a large portion of the required capital, and



bringing into operation the energy and activity of associated private interests, with due regulation and control on the part of the public: thus individual interests and exertions will be enlisted in the public service, and the great object more efficiently attained by this co-operation than if made exclusively a matter of public administration.

Also, there will be a division of labour and responsibility upon a principle consistent with the respective objects to be attained, and a proper balancing of the principles of centralization with distribution, according as each is properly adapted to the object in view.

Further, it will be seen on a general view of the result of the calculations, that, independently of the *sanitary benefit*, there will be a *satisfactory and encouraging return* for the outlay to be invested.

(Signed)

CHARLES FOWLER.

Gordon-square, August 25th, 1849.

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F. FINLAY, Esq. C. E.

26, Duke-street, Westminster,  
July 16th, 1849.

IN commencing, I beg to say this proposal is not developed to its full extent.

Considering the localities required to be drained, and the very large outlay consequent, it is of great importance the works should be done as efficiently as possible, keeping in view the probability of a good return upon the outlay, that so far it should be applied as much as possible to the benefit of those parties who will be liable to be called upon to provide the means, and also to the consumers within the district. Under this impression, the whole of the works connected, from the collection down to the supply (I take it for granted it is understood to what purpose the refuse is to be applied), should be borne by the Commission, whereby the public may have the full advantages to be derived. If it is worth the consideration of a Company to form itself for the purpose of purchasing the refuse, and then to retail again, why surely the advantages which they anticipate should be secured to all whom it may concern, and whose property it is; the expense of retailing it cannot be more to a Commission than to a Company, and I consider would be much less; they having the whole machinery in operation could dispose of it from time to time, and according to circumstances, as in practice there might possibly be points arise requiring further consideration, and perhaps revision, which would be attended with difficulty if a contract was entered into with a Company; for instance, perchance the supply might not be kept up, or the Company might

not dispose so fast as desirable, or their rate of charge might be too high for the consumer, which would tend to affect the consumption to a great extent; the whole working of the system should be kept up with the greatest uniformity.

The principle upon which I propose to drain would not affect the present arrangement of sewers, but add facility to their discharge. Upon referring to the plan accompanying, you will there see that I have shown an arrangement of diverging drains, commencing at the centre of the Metropolis, to be kept in perfect straight lines in every case, and beginning at a depth, say about twelve feet below the lowest level of the present sewers; by this arrangement we have the advantage of making communication at any and as many places as desirable along the several lines of sewers now in operation, and also the opportunity of draining any locality most convenient to the surface of ground, or otherwise discharging into the main, or receiving drains at any number of places, by means of shafts, thereby doing away with the necessity of any alteration of the present sewers. I propose to take the main, or receiving drain, in two or more lengths, to the extent of the metropolitan district, being 12 miles radius (see accompanying section), the fall to be about 17 feet in a mile, egg shaped, 4 feet 6 inches high, 2 feet 6 inches wide in the clear, throughout to be lined with glazed surface bricks, compressed and made hollow, and to the shape and size best adapted for the purpose, put together with a fine water-tight joint in cement; this will form a space of excavation 6 feet high and 4 feet wide, sufficient for three workmen to be employed at one time. It is necessary to have the drains of large dimensions at the extremities, the supply of refuse required being in proportion to the radius. Vertical shafts to be sunk wherever the communication will take place with the present sewers, and from every shaft headings or works may proceed both ways at the same time; by this arrangement great facility will be afforded in the execution; by this method of working any number of the drains may proceed at the same time, and I consider the whole system might be completed in two years.

It is well known that the Metropolis, and a very large district of the suburbs, is upon the London clay; and by going to the depth, as I have before stated, about 12 feet below the lowest present sewer, we should get into the clay at once, consequently the greatest portion of the works would be in the clay, which is of much importance; beyond this we should meet with chalk, and here we should do equally well, the nature of each being such we could tunnel to the form of drain without difficulty, and complete the brickwork as we proceed.

After going the first six miles, and having obtained a declivity of 100 feet, I should elevate the drain again to a level, necessary according to the locality or level line to be continued; at this point I commence lifting the refuse into tanks, and propose three other shafts, or one in two miles distance along the line, each of these shafts to be supplied with two sets of engines, lifting apparatus, receiving tanks,

and tackle or machinery for working the system: it is necessary to have double sets in case of derangement. At the first of these shafts I propose to have two powerful pumps, or lifting apparatus, that will be able to take off and deliver one day's supply of refuse in twenty-four hours to the next length of drain. The first length of six miles will contain one day's supply; it being on the incline, and in a straight line, no obstruction could present itself, and thereby avoid any deposit; in addition to the two apparatuses above, I propose to have the others, and also two to each intermediate shafts, their proportion of power is to the supply to the receiving tanks, and which apparatus continues to work during the flow of the refuse down the drain, the receiving tanks to contain a quantity in proportion to their distance or radius along the line. Having a greater area of ground to supply, they should also contain one month's supply, and there should be two at each shaft, so in working one could be filling while the other is being cleared of its deposit. I propose to cover the whole of the receiving tanks with light zinc roofs, and to be kept low to condense the atmosphere as much as possible, and would apply the soot obtained from the Metropolis to destroy the effluvia, which is also a good manure.

The receiving tanks in every case should be placed on as high ground as practicable, with the view that the supply pipes to consumers may be as self-acting as possible, as would also be the case in its course into the carts, or otherwise to be used for agricultural purpose.

#### SURFACE DRAINAGE.

There being a very large quantity of upland water, and also surplus rain water in the Metropolis passing down the present sewer, I propose its course should not be disturbed; but in each of these sewers I would lay two feet drain pipes to carry off the refuse, which can communicate with the vertical shafts as described before. I further would have the streets which are paved washed down, say twice a week, into the refuse drain, that a trap can be formed to the same inlet, which might be opened or shut when required by the scavenger, so that after washing the street the trap to be left open for rain, which would then pass off into the river.

I assume a population of 2,000,000 and that each person will make 16 tons of refuse per annum, which, in the whole, amounts to 32,000,000 tons, or 87,671 tons per diem; and that the refuse of three people is sufficient for one acre (Falkner's Account, in his Muck Manual, states one person is sufficient), will give a supply to 666,666 acres. Taking the radius twelve miles, the metropolitan district then is 289,493 acres, deduct therefrom a radius of five miles for the Metropolis, which is 50,240 acres, leaves but 239,253 acres, consequently it will be necessary to extend the radius seven miles further, which will add 436,367 acres, making



in all 675,620 acres required; in continuing this extension I propose to carry it out upon the same principle as the former, and hereby keeping the main drains low down, would give opportunity for any local town or village to join, securing to them plenty of fall; the drains leading from them need not be larger than, say two or three feet, according to circumstances; in the event of their going a distance, the expence would not be great, they would be guided by circumstances as to depth; and in consideration for any such town or village so doing, I would propose the following arrangement should be made; the profit of amount derived from the sale of such refuse should be divided to each parish town or village, in proportion to its population, the money so apportioned to be laid out for the improvement generally relating to sanitary measures, such as water, lighting, paving and cleansing the streets, &c.

In carrying out this principle any line can be executed at one time, and to any extent, beyond the first six miles, thereby giving an opportunity for obtaining experience, which may be desirable, as also for the means necessary in the event of any line being partially executed, a further extension can be made without affecting the working of that already completed; but until the whole distance of a line is complete, the outlet of the present sewer must not be closed up, but allow the overflow to retain its course.

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J. FAULKNER, Esq.

August, 1849.

*Firstly.* The construction of two tunnels, one on either side of the Thames, to receive the whole sewage matter, and convey it to the open reservoirs, at their respective ends.

The one on the Middlesex side, commencing in the Parish of Fulham, and ending below Bow-creek, in the Plaistow Marshes. That on the Surrey side, commencing above Putney, at Barnes' Elms, and finishing near Deptford.

*Secondly.* To excavate a space of ground below the level of the bottom of the tunnel, to hold 10,000 cubic yards of sewage matter. In times of storm, &c., to the top of the tunnel, 50,000 cubic yards, besides what would be contained in the tunnel. And up to the level of high water mark, 80,000 cubic yards; consequently, at the four openings, the whole would be four times that quantity.

*Thirdly.* From the above first receivers, the sewage matter to be lifted into "backs," for filtration and deodorising, and then the water to be returned into the Thames, and the deposit disposed of as manure.

*Fourthly.* The sinking of shafts, for the purpose of communication and cleansing the sewers, and the erection of high and ornamental chimnies or towers,

for the purpose of carrying off the malaria and gases of the sewers, after having been made fit by process to be again received into the atmosphere.

*Fifthly.* To lay down a line of rails in the tunnels, for the purpose of cleansing the main trunk sewers on either side, at their intersections with the tunnels, from any deposit that cannot be removed by flushing or otherwise, and carrying it to the four deposits at the ends of the tunnels, without being brought into the streets.

*Sixthly.* To make the drainage of all property into the sewers compulsory, and the construction of all sewers to be made by the Commissioners, or under their supervision, and to become the property of the Commission, so soon as they are constructed, with certain regulations for the repayment of the outlay.

*Seventhly.* I also propose to connect with my scheme (but it is not essential to the carrying out of the other portions of it) the supply of water to the Metropolis, which should be placed under the management of your Commission, to secure a more ample and pure supply.

*Eighthly.* That the supply of water to all privies, water closets, and other accumulation of filth, should be compulsory, in order to carry the same into the sewers; and to provide means in the arches of the sewers for suspending the water pipes, and laying down in them one uniform line of pipes, so that they could be examined, repaired, and attended to, from the sewers, without taking up the pavement of the streets.

Devonport Dockyard, August, 1849.

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JOSEPH GIBBS, Esq., C.E.

As the Statement of Mr. Gibbs occupies thirty-nine pages, it was considered too long for insertion here. A few copies of that Statement are at the Principal Office. Application has been made to Mr. Gibbs for a sufficient number of copies to be circulated amongst the Commissioners, but they have not yet arrived.

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CHARLES HUTTON GREGORY, Esq., C.E.

THE plan proposed is to receive the sewage from the existing outlets in closed tanks, constructed to float up or down the river by the tide or stream, and which shall discharge their contents into remote parts of the river, or into independent sewers, or disinfecting reservoirs at a distance from the population, or where required for agricultural purposes.

To carry out this system, a close iron outlet box would be constructed, either at the sewers' mouth, or between it and low water mark, and connected with the sewer

by a close pipe. Branch and outlet pipes (closed at pleasure by slide-cocks), would lead from the outlet box to close wrought-iron tanks, constructed with air-chambers adequate to their floatation, and which would be connected one after another, filled with the sewage, and floated away.

In order to provide for the continual free discharge of sewers lying below high water level, it is proposed, in such cases, to moor tanks down, at low water, by catches fixed to screw-piles, which would be released so as to allow each tank to float when filled.

The tanks, when floated to their destination, might be discharged by their own feed-pipes, or by syphons, into the river, six or seven miles below the town, or upon the low lands adjoining the river above and below, or elsewhere where required.

The cost of tanks, including connections, &c., is estimated at £500 for a tank containing 10,000 cubic feet of sewage. This amount would also provide for the proportion of outlet boxes and other plant, if the plan were carried out to a large extent. The use of steam tugs for removing the tanks in trains, would enable the tanks to return in two tides on an average; so that the cost of construction may be reckoned at £500. for every 10,000 cubic feet of sewage discharged and removed per diem.

The cost of working would, in most cases, be limited to the expense of lightering or towing, with the wages of a foreman at each outlet.

It remains to be determined what amount of sewage may be removed in the day by this means, without undue obstruction of the navigation of the river; at the same time it is submitted that, so far as the plan might be adopted, it would possess the following advantages:—

That it may be extended to the removal of a large amount of sewage, with, comparatively speaking, no land works, with no injury to property, and without the necessity for expensive and unhealthy alteration of existing sewers: that its progressive advance would be immediately productive of proportionate purification of the river and its banks: that the cost of construction would be a certain and determinate amount, and that it would avoid the necessity of tunnelling through variable strata of which little is known, and that little showing, by past experience, a prospect of great risk and incalculable cost, and that it affords the means of taking away the low level sewage without interruption, at all states of the tide.

(Signed)

CHARLES HUTTON GREGORY,  
Civil Engineer.

1, Delahay-street, Westminster.



JOHN THORNHILL HARRISON, Esq.

*To the Commissioners of the Metropolitan Court of Sewers.*

Gentlemen,

THE scheme which I had the honour of laying before your Honourable Board comprises :—

1st. The removal of the sewerage matter of the Metropolis to the Plaistow and Plumstead Marshes, arrangements for its filtration, and the formation of a canal through each marsh, as a reservoir for the filtered water during high tide, the canals at the same time effecting the drainage of the Marshes, and being used by barges for conveying away the manure from the filtering apparatus.

The removal of the sewerage matter to the marshes is proposed to be effected by means of two tunnels, each eight feet in diameter, carried along the base of the hills on each side of the river, nearly under the line of contour, ten feet above Trinity high-water mark, extending from Hammersmith to the Plaistow Level on the north, and from Wandsworth to the Plumstead Marsh on the south.

The tunnels are to be kept full, and the water to have a constant velocity of six inches per second through them, the supply being derived from the Thames when that from the house drainage is insufficient.

*30 ft 1/2 minute  
100 ft 1 hour a 2.040 miles flow*

The tunnels are double, for the purpose of flushing them with any required velocity, up to three feet per second, without interfering with the cross drains of the low grounds, which are to be shut off for the time from the tunnel which is being flushed.

It is estimated that the rise of tide will afford the head requisite to give a velocity of three feet per second, whilst the low-water level at Wandsworth and Hammersmith will afford ample head for maintaining the ordinary velocity.

2nd. A system of drainage for the low lying parts of the Metropolis, by means of cross drains from the river to the tunnels, similar in principle to that proposed for the removal of the sewerage matter to the Marshes; the tidal rise of water in the river affording the means of thoroughly scouring the cross drains twice in every twenty-four hours.

The level of the surface does not admit of this system being adopted throughout, but the district to which it is inapplicable is, so far as I can ascertain, very limited. When the difficulty exists, it is proposed to scour the cross drains twice a day, from

the tunnels into the Thames, the drains being laid at any required level, and the water used for scouring being pure.

3rd. The conveyance of a large portion of the water from the hills on the south side of the river, in one of the tunnels, to the Plumstead Marsh, which water is to be used in scouring the cross drains into the Thames, as mentioned above.

4th. A provision for flushing the existing main drains lying across the flat between the tunnels and the river, by drawing off any quantity of water from the tunnels for the purpose, when required. By performing the operation early in the morning, the water drawn from the tunnels would be nearly pure, the supply during the night having been derived from the Thames.

5th. An arrangement for the main drainage of the districts lying between Twickenham, and Wandsworth, and Hammersmith, respectively. The principle being the same as before described.

The whole scheme is founded on the supposition that, with the exception of the water from the hills on the south side of the river, the removal of the house drainage alone is to be provided for, the street and land drainage being accomplished by the existing system of sewers, assisted across the flats by the means mentioned above.

I remain, Gentlemen,

Your obedient servant,

(Signed)

JOHN THORNHILL HARRISON.

East Boldon, near Gateshead,

August 23, 1849.

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M. KERRIDGE, Esq.

August 25th, 1849.

Sir,

I received your letter, requesting a concise statement of my plan for the drainage of the Metropolis. I hereby comply with your request. The objects I have sought to accomplish are:—To prevent the offensive smell from the gully-holes in the streets; to relieve the river of the mass of impurities it now receives; and to dispose of the same for manure: to accomplish which, I propose to lay down in all the existing sewers an earthen drain pipe, connected with the house drains, so as to receive the household water only, leaving the other portion of the sewer for the rainwater. Let the rain run into the river as usual, but the contents of the pipe convey into small tanks, to be pumped by an engine into reservoirs outside the town,

covered over, so that as the manure enters the air is forced out through a purifying liquid ; or convey it to the country at once, by pipes laid by the side of the different railways, with reservoirs at convenient places. The contents of the sewers, as they are at present, might in dry weather be disposed of by this means.

I have the honour to be, Sir,

Your obedient servant,

(Signed)

M. KERRIDGE.

26, Shouldham-street, Edgware-road.

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THOMAS LUNT, Esq.

*Metropolitan Commission of Sewers.*

My Lords and Gentlemen,

So important and so earnest do I consider the labours of your Court ; fully satisfied that every suggestion is in desire to advance a *great* cause ; unfit as I am to interfere, I feel confident in your forbearance.

The important use of sewers to carry off superfluous water, no one will question ; but we have many warnings that it is not right to introduce fertilizing manures into them—earth, air, and water is by nature pure and congenial to man ;—but we often see statements in your Reports of gas, deadly effluvia, &c., being generated in the sewers and escaping into warm apartments, and thus enfeebling the constitution.

The principle of properly applying fertilizing manures will also be found congenial to man ; as proof, the more liberal supply of them in the neighbourhood of towns, the abundant yield of the land. Facility of communication now commands a like advantage to heretofore neglected parts. We see, too, the merciful Author of all good opening men's minds and dispositions to patient enquiry after means of success.

Your Metropolis will divide into many districts ; but the buildings, pans, or troughs as receivers of all refuse manures might be adopted with much sameness ; said copper or iron pans, to be emptied into similar carts, and taken to places for any requisite preparation, and for sale.

The enriching nature of these arrangements,—first remunerative returns in discharge of costs, the extension of more approved employment, will invite men to faithful responsibility and feeling dispositions, thus promising results of progressive happiness.

I am faithfully, &c. &c.,

(Signed)

THOMAS LUNT,

August 25th, 1849.

Chester.



## JOHN MARTIN, Esq.

IN accordance with the directions of the Honourable Commissioners of Sewers, I herewith forward a concise Report of the advantages offered by my plan of draining.

1st. That it excludes all drainage, natural and artificial, from the Thames, thereby greatly improving the salubrity of the Metropolis, and the health and comfort of its inhabitants; and that one outfall only is sufficient for natural or surface, as well as artificial or house drainage.

2ndly. My plan of circular branch drains collects, at the least expense, the whole sewage of the suburbs of the Metropolis, and forwards the same quickly to its destination.

3rdly. That my plan of man-holes permits of an easy and continual inspection of main sewers and main branch drains, thereby removing impediments from all contributing sewers, and detecting immediately any stoppages that may occur, so that a remedy may be quickly supplied without disturbing the streets above, or in any way impeding the public traffic.

4thly. By completing shaft and receivers first, and working from the terminus through London, the works commence repayment of the sum advanced even before the whole line is finished, which will be in about eighteen months.

Lastly. The whole works—mains, sewers, and branch drains included—will not exceed £660,000, which sum, if advanced by Government, will repay itself, principal and interest, in sixteen years, without any additional tax on the ratepayers.

I am,

Your Honours' obedient servant,

(Signed)

JOHN MARTIN.

MESSRS. JOHN MARTIN, WM. SOWERBY, Jun., and J. HODGSON JONES.

52, Parliament-street, Westminster,  
August 23rd, 1849.

*To the Honourable Metropolitan Commission of Sewers.*

IN compliance with the request contained in the Resolution passed at the Court of Sewers, on the 20th instant, we beg to lay before you the chief features of the

plans which have been sent in by us, for the thorough drainage and improvement of the Metropolis, the principles of which were laid down by the undersigned John Martin, K.L., upwards of twenty years ago. The details for effecting such plans have been slightly altered, and are as follow, namely :—

To divide the Metropolis into convenient drainage districts.

To form a series of intercepting sewers, adapted to each district, at the lowest outfalls of all existing sewers, as by this means any required amount of fall could be obtained, without increasing unnecessarily the depth of the sewer: all local difficulties, such as dock entrances, blocks of public or private buildings, &c. would be avoided, as the lengths of sewer could commence at each side of the obstruction; and the construction of many miles of intercepting sewer, where there are no large outfalls, would be saved.

It is not proposed to interfere with the existing system of sewerage, except by making the sewers more efficient where requisite, such improvements to commence at the lowest point, working upwards; and by converting certain sewers in the neighbourhood of the river into intercepting sewers.

The tide is to be effectually excluded, and all sewers efficiently trapped and ventilated.

A station, with pump-engines, to be placed as nearly as possible in the middle of each section of intercepting sewer, and immediately adjacent to the river. The pumps and silt-well being so arranged, that no sewage will be allowed to pass into the river, whilst the run of the sewage will always be maintained.

A ready means will be afforded for pumping the sewage into the country, and distributing it for agricultural purposes. In dry seasons, the water of the river could be supplied, either for diluting the sewage or for watering the land.

By the proposed means no sumps will be required, any surplus sewage being at once conveyed to the elevated country receptacles.

It is proposed that the suburban districts and villages shall be treated separately, when the house drainage might be divided from the surface drainage, as originally suggested by Mr. Martin, and provided with an engine-station proportionate to the population of the place.

The estimated cost of the proposed works, including the suburban districts and villages, is as follows :—

For construction of intercepting sewers, and alteration of existing sewers, for the same purpose .....	£59,961
Engines, stations, boilers, pumps, coal-stores, dredging machines to silt-wells, stand pipes, sluice valves, and flood-gates, pump-well, complete .....	224,975
Main-pipes for three miles from each station .....	92,400
Cost of ground for stations .....	10,000
	<u>£387,336</u>

(Signed)

JOHN MARTIN.

WILLIAM SOWERBY, JUN.

J. HODGSON JONES.

## MR. MARTIN'S WATER PLAN, IN CONNECTION WITH THE DRAINAGE PLAN.

By this plan it is proposed to afford the whole of the Metropolis an inexhaustible and unintermittent supply of pure water, from a point of the river Thames, immediately in the heart of London, by the following means:—

To construct a weir across the Thames, a little below the Houses of Parliament, or near to Hungerford Market, where the traffic between the upper and lower portion of the river at present divides; and

To form upon the top of the weir a bridge, to supersede the present Westminster-bridge.

By means of the weir the whole of the upper portion of the stream would be retained as an inexhaustible reservoir of running water. The stream being relieved of the sewage, and separated from the tidal waters and pollution accompanying the constant traffic and shipping in so large a port, would be rendered fit for every domestic purpose; the beauty of the river would be permanently augmented, and the navigation improved, as the stream would be maintained sufficiently deep to be at all times navigable by even large vessels. The arrangements for working the locks, and letting off the superabundant waters, in time of flood, would at the same time screen from view the trade and factories between Lambeth Palace and the weir, and opposite the Houses of Parliament and Privy Gardens, whilst the business would all go on as at the present. The means of flushing the sewers with pure water would be obtained in those low levels, such as Westminster, where there are at present no natural means of flushing.

Many miles of large mains from the suction points of the various Water Companies to their town reservoirs would be saved, whilst no fresh pipes would need to be laid, as the water would be projected direct from the river into the existing



mains and services. All the present settling and other reservoirs would be re-covered. And, finally, by applying the water-power gained at the weir, either to pumping the water to the different levels, or other engineering, a great amount of steam-power would be recovered.

It is farther proposed to improve the banks of the river, and afford convenient landing-places.

The estimated cost of the whole is £350,500.

(Signed)

JOHN MARTIN.  
WILLIAM SOWERBY, JUN.  
J. HODGSON JONES.

T. MORRIS, Esq.

THE waste to be divided into clean and foul currents, as exemplified in country mansions (a point advanced previously to, and independently of, the Report by Mr. Phillips).

All needlessly gigantic means to be avoided.

The existing sewers to be generally applied to the removal of the surface water only; and being thus freed from offensive smell, possess, by their facility of access, an advantage over new drains of small size.

Pipes for the liquid soil are to be inserted along and under the present sewers, and exhausted by machinery. The quantity to be removed, and the scale of the pumping works, being regulated by the statistics of the water companies.

Districts to be classified according to level, as—

1. Elevated localities, declining to the river, but never falling below high-water mark, and requiring no mechanical contrivance.

2. Similar districts intercepted by parts lying below high-water mark. In this case, after taking the common drains to the lowest level commanding a constant outlet, close syphon tubes, made self-acting, are to be used, and the drainage thus passed through the lowest districts, without inconvenience, and regardless of undulations not exceeding thirty feet.

3. Districts lying below high-water mark, in which, after taking advantage by syphons, of subsiding tides, mechanical power must be resorted to.

The total cost of applying this method to 200,000 houses, estimated at £300,000.

The necessity of ventilating the sewers is superseded.

(Signed)

T. M.

August 25th, 1849.

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J. B. M'CLEAN, Esq.

17, Great George-street, Westminster,  
25th August, 1849.

E. H. WOOLRYCH, Esq., *Secretary to the Metropolitan Commissioners of Sewers.*

Sir,

IN conformity with your circular of 22nd instant, I beg to submit for the information of the Commissioners of Sewers, the following concise statement of the main features of the plan which I have already sent in for their consideration.

I propose to direct the River Fleet from Battle-bridge, near King's-cross, by means of a sewer of twelve feet diameter, which will convey it to the River Thames, below Bow-creek, leaving the present Fleet sewer between the City-road and the Thames, for flood-water only. The new sewer will pass through Islington, and under the Regent's Canal, near the City-basin (by tunnelling through the London clay), and thence, constructed in the ordinary way, along the canal, through the Victoria-park, across the Mile-end-road, to Limehouse-cut, where gates will be provided to regulate the discharge of the drainage, in case it shall be found desirable to send it through pipes along the River Lea, or the Regent's Canal and Paddington Canal. It will then fall to a lower level, in which it will receive the drainage from the low districts of the Tower Hamlets, &c., and pass under the River Lea and out to the Thames below Bow-creek. The whole of the drainage, north of the River Thames, with the exception of the low parts of Westminster, and the frontage to the river between the Tower and Westminster, will thus be conveyed through this outlet; and the alterations required for connecting the existing sewers with it, will not be expensive.

Another principal feature in the proposed plan, is the drainage of the low district of Westminster, and the river frontage above the Tower, through the Surrey and Kent districts, and at the same time giving the most effectual natural drainage to those districts. This I propose to do, by collecting the low sewage north of the

Thames (as shewn upon the plan), into the King's Scholar's-pond sewer, and conveying it under the river, by means of a bent wrought-iron culvert, and thence by means of a brick sewer, through Surrey, along the boundary ditch of the Surrey and Kent districts, nearly parallel to the Surrey Canal, as far as the Croydon Railway, and thence under the canal, and along the Greenwich Railway to Greenwich, passing in its course under the River Ravensbourne. From Greenwich it will pass, by a tunnel sewer, through Greenwich Park, and thence through the East Greenwich Marshes into the Thames. The fall, throughout the length of this sewer, will be one foot per mile, which is sufficiently great for natural drainage, and more especially so in the present case, when the difference of level, and the time of each tide, at Greenwich and Vauxhall, will admit of an immense body of Thames water being sent through the sewer daily.

These two outlets will afford complete means of natural drainage for the whole of the districts of the Metropolis, without the aid of machinery of any description; and by means of an enlargement of the sewers at each outlet (sufficient to contain the drainage for seven hours), the whole may be discharged into the Thames during the first five hours of ebb tide, and thus prevent its returning back with the next flood tide, the point of discharge being upwards of seven miles below London-bridge. The enlarged portions of the sewers, which will in each case be in the marsh land, will afford facilities of procuring solid manure from their contents, and in localities where the manufacture would not be a nuisance, and whence it might be readily exported, in case any company should be formed for that purpose. Whatever amount of rent may be received for the contents of the sewers, will be a profit to the rate payers, as no expense will have been incurred, beyond what was required for obtaining efficient drainage.

On both sides of the Thames, the present system of drainage may be adapted to these outfall sewers, without great expense. I do not expect the cost of the whole to exceed £450,000; say, £300,000 for the main outfalls, and £150,000 for connecting the present sewers with them.

I have the honour to be, Sir,

Your most obedient Servant,

(Signed)

J. B. M'CLEAN.

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JOHN MURRAY, Esq.

THE Thames, in consequence of the great volume of water carried past London, is considered the chief drain of the Metropolis. By taking advantage of the lowering of the water surface, by the removal of the old bridge, the mouths of the sewers might also be lowered, to give a more efficient drainage; and, in place of the



outfalls discharging their contents over the mud and filth deposited on the shores left dry by the receding tide, it is proposed to carry them directly into the stream of the river, at the different bridges, or at central towers to be erected between them, whereby the feculent matter and effluvia would be lost in the current.

It is also proposed to convey the drainage and sewage of the suburban upland districts into two catch water sewers, tunnelled through the blue clay; the one commencing at Kentish-town, the other near Westbourne-green, and both discharging into reservoirs in the West Ham Marshes, and from thence, through canals or open cuts, into the Thames. The outfalls of these sewers being placed at the level of high water, would give a natural drainage, independent of the rising of the tide, to a large portion of the Metropolis. The outfalls being also distinct from those of the low districts, would permit the latter to be drained separately, and without being deluged with water, during heavy rains, from the uplands. These catch water sewers are proposed to be flushed from reservoirs filled with the waste water which now runs into the brooks and drains in the vicinity of Highgate and Hampstead.

Another district, between Hyde-park and the City, bounded on the north by Portman and Russell-squares, being thus relieved from a great deal of the upland water, is proposed to have its drainage improved by a new sewer, commencing at the Serpentine River, and discharging into the Thames, midway between Waterloo and Blackfriars-bridges, using the water from the lake for the purpose of flushing it. To supply the Serpentine with water, a steam engine is proposed to be erected near Chelsea Hospital, to pump from the Thames, through pipes, which are proposed to be continued to the Westbourne-green reservoir, above mentioned, with the intention of aiding its flushing operations during a continuance of dry weather.

The low district of Westminster is proposed to be drained through a new sewer, from Charing-cross to the Counters Creek sewer, intercepting the old drains in its course, and discharging at and about the period of low water, into the deep current of the Thames at Westminster-bridge. When the tide rises and shuts the flap doors, the steam engine, just mentioned, may pump the remainder into the Thames, or assist the operations of the Metropolitan Sewage Manure Company, if considered desirable.

The City sewers, which now discharge by separate outfalls through the quays and wharfs on the bank of the river, are proposed to have several of them united into one main sewer; and, by means of large iron pipes, have their outlets laid at the level of low water of spring tides, in the deep water of the river, free from the deposits upon its shores. To scour and flush the City sewers, it is proposed to pump up the water from the Thames by the New River Company's steam engine at Broken-wharf, into a reservoir, to be formed in Finsbury-square, which might be made ornamental to the neighbourhood.

The drainage of the low districts of the Tower Hamlets and Poplar, are proposed to be improved by the formation of a new sewer, intercepting the old drains, from the Tower, eastwards, to a reservoir in the West Ham Marshes, and from thence discharging into the Thames, at the levels of low water of spring and neap tides; when these outfalls are closed, a steam engine may pump up the remaining quantity, if requisite.

It is proposed, in future, when new main sewers are built, that they pass along the middle of the street, at a low level; that the drainage and sewage pass into it, through service sewers, formed of glazed tubular pipes, laid on each side; that each service sewer communicate with the main sewer, at intervals of 300 or 400 yards, having a simple self-acting flap at its mouth; and that the house drains be connected with these service sewers only, and, in no case, with the main sewer; consequently, a system of flushing might be adopted, with a head of water sufficient to force forward all deposited matter, and closing the flaps of the service sewers, would carry along with the water the foul air generated in the sewer, and purify it. There would, then, be no necessity to make the main sewer so capacious as at present; and the reduction of cost would go far to defray the expense of these service sewers.

The whole drainage area appertaining to London, on the northern side of the Thames, may be subdivided thus:—

	Acres.	Acres.	
The City forms .....	850		
The high parts of Westminster ..	1,580		
	<hr/>		
Together..	=	2,430,	which would have a natural drain- age directly into the Thames.
The low parts of Westminster ..	2,470		
Do. Tower Hamlets.	1,620		
	<hr/>		
Together..	=	4,090,	might require the partial aid of ma- chinery to drain them effectually.
The suburban upland districts ...	=	9,980,	would have a natural drainage at all times, independent of the tide.
	<hr/>		
Total..	=	16,500	
	<hr/>		

Although not forming a necessary part of the scheme for the efficient drainage of London, yet, it appears, that the great bulk of the sewage manure might be collected into a series of reservoirs formed in the West Ham Marshes; admitted into each separately, allowed to settle therein, and the water drawn off in a more pure state into the Thames. The sale of the manure, in a liquid and solid state, would, in part, repay the expenditure proposed to be incurred in the formation of the sewers.

The estimated cost of the works herein proposed, exclusive of these sewage reservoirs, is £325,000.

Southwark and the suburbs, south of the Thames, are naturally distinct districts of the Metropolis. Its drainage and sewage ought to remain so. To improve them, would be to recommend the principles herein adopted, of carrying off the upland water to separate outfalls from those of the low districts; and, no doubt, a plan could be formed for accomplishing so desirable an object.

(Signed)

JOHN MURRAY,  
Nat. Inst. C. E.

26, Parliament-street,  
Westminster.

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JOHN PHILLIPS, ESQ., CHIEF SURVEYOR.

The Statement of Mr. Phillips' Plan has already been sent round to the Commissioners.

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T. W. PLUM, ESQ.

1st. THE entire exclusion of night soil and other foul refuse from the sewers, thereby freeing the streets from noxious exhalations, and rendering the return to untrapped gullies practicable, as it is on many accounts most desirable, as well as preventing a large amount of injurious deposit in the Thames.

2nd. The formation of public soil tanks under the streets, (according to a plan of construction to be hereafter furnished), to receive the night soil, &c., from limited numbers of houses; vent-pipes being used in connection with the tanks to relieve the house-traps from the pressure and consequent escape of foul gases (which improvement is applicable to other systems of drainage), the surplus fluid to be filtered and deodorised in its progress from the tanks to the sewers through which it may then pass.

3rd. The removal of the contents of the soil-tanks periodically (by a process of cartage now in use) without injury or annoyance to the inhabitants, under contracts, the machinery for which to be used in contracting for the removal of dust and other refuse, so that the whole of the sanitary operations of each district may be under the supervision of one inspector, subject to one control.

4th. Affording to the agricultural districts in every direction round London, with equal facility and cost, an uninterrupted supply of sewage manure in a condition of greater value than if deprived of a large amount of its fertilizing properties by repeated long-continued exposure to atmospheric action, with a greatly enlarged evaporating surface.



5th. The existing sewers to be made available, and thus restored to the uses for which most of them were originally constructed, their extension may be carried on simultaneously with the house drainage, affording progressively the prompt relief so much required.

In a sanitary point of view, the chief advantages will be:—

1st. Security from noxious exhalations, either in the houses, in the streets, or by the river side; as well as from the danger of having impure water for domestic uses.

2nd. Greater security from the injurious effect of storm water, by its more rapid escape from the surface, owing to the diminished causes of stoppages in the sewers, and the facility to be derived from the use of untrapped gullies.

The cost (whether in time or money) of constructing one tank and complete set of house-drains, for testing their efficiency, would be inconsiderable compared with the advantage to be derived from a practical experiment, whereby the great risk involved in the adoption of expensive theories may be avoided.

(Signed)

T. W. PLUM,  
Architect and Surveyor.

25th August, 1849.

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JOSEPH PRESTWICH, JUN., ESQ.

It is for the suggestion of a principle, rather than as the estimate of a plan, that the offer of this communication is ventured; its object is—

To show, that the present sewers may be made efficient, and that it will be more advisable to improve and extend them than to replace them by new works.

That the joint drainage of the houses and streets should be effected with uniformity of action, to the prevention of stagnation and of all contact of the sewage with the external atmosphere. These, conjointly with preventing the pollution of the Thames, and economising the products of drainage, are the chief points for consideration, and to effect which it is proposed—

To construct at the mouth of each main sewer two or three closed chambers of a joint capacity, sufficient to hold, excepting in heavy rains, the quantity of sewage matter discharged by each sewer in the twenty-four hours. By means of sluices the sewage to be made to run alternately into each chamber, the form of these chambers to be square or triangular, with sides perpendicular for ten to twelve feet, and then sloping gradually inwards, and terminating in a point.

To show, that, as fresh collected sewerage matter resolves itself after a short repose into two parts, the lesser one, a semi-fluid sediment, and the smaller one, a supernatant liquid, if the vessel in which it is collected were tapped at the bottom, the sediment might be drawn off, and the separation of the more offensive part thereby effected; and if, therefore, the bottom of each chamber were connected by means of a valve, with a branch pipe two feet (or more or less as occasion might require) in diameter, and all running into one main pipe, it is evident that the sediment might be drawn off and discharged through this pipe, leaving the supernatant liquid to be dealt with afterwards. If now this common pipe, receiving in succession the sediment from the closed chambers, were carried perpendicularly to a depth of forty to fifty feet, and then connected with an horizontal pipe or sewer, of a diameter of four feet (or more or less as may be shown to if required), a pressure would be exerted, if the descending pipe or shaft were kept full, equal to the height of the column of matter in the shaft, multiplied by the area given by a section of the lower pipe or sewer. This would probably vary from twenty to twenty-four tons, according to the depth of the shaft, and the specific gravity of the sediment. A propulsive force is thus obtained to act on the matter in the lower pipe or sewer, and to force it towards its open end; and as it receives its contingent of sediment from each sewer that is connected with it, then in addition to the uniform propulsive force exerted by the several columns of matter, there would be the multiplied velocity obtained by the joint action of the several sewers it receives. The flow of the matter from the open end of the lower pipe or sewer to be regulated by sluice valves; this lower pipe or sewer, as well on the several sewer shafts to be kept always full, whereby the constant action of an important force would be obtained, and the danger of the lower sewer or pipe becoming silt clogged materially diminished. There would further be the fall of the lower sewer or pipe to increase the effect. The lower pipe or sewer to be connected with a terminal reservoir.

To show, that from the geological difficulties of executing any underground works between Limehouse and Plumstead, and on the contrary, from the extreme facility presented by the existence of a persistent mass of London clay, 150 to 300 feet thick, between London and Chiswick, the lower pipe or sewer could be carried with much less expense, and with greater advantage, to some point on the banks of the Thames between Chelsea and Chiswick, there to empty itself into a closed reservoir.

To show, that for inland distribution of manure a reservoir up the Thames would present greater facilities than one down the Thames.

To show, that owing to the great difference of level of the sewers on the north and south side of the river, two lower sewers or pipes would be necessary, one for each side of the river.

To show, that regard to the supernatant fluid in the closed chambers, it could be, if necessary, carried in water pipes on the level of the closed chambers to any point up or down the river,\* if it were not an object to save it, then it might be carried along by pipes down the river, and emptied into it at a distance, or it might be discharged into the Thames by means of waste pipes passing from the closed chambers, and connected therewith by valves opening as required, into the middle and at the bottom of the river. The discharge to take place during the falling tide, by which means no sewerage matter would be exposed on the banks of the river, and the speedy removal of the liquid portions of it would be ensured.

To show, that in case of heavy rains a self-acting valve would let off from the closed chambers, by means of openings in the upper part of them, the excess of water. When the sewers are much below the level of high water, small steam engines would be necessary to draw off the waste water of the sewerage matter.

To show, that as the flow of the sewerage matter into the closed chambers would cease as soon as it rose to the level of the current from the sewer, there would be no back water, and the essential point of a constant flow would be ensured.

On this system each town in the neighbourhood of London would have its own separate system of drainage, although the lower pipe or sewer from several might run into one common reservoir or reservoirs.

To show, that the chambers at the end of the sewers being arched over and closed, and the pipes opening into them being always full or under water, no current of air can pass upwards into the sewers.

To show, that by separating the sewerage in the closed chambers, an important saving of cost is effected by the much smaller size of the works required to convey the most offensive, but smallest portion of the sewerage matter to a distance, and again by discharging at once the supernatant liquid, and not having, after having removed it to a distance, to raise it again from a considerable depth to the surface. Further, the sewerage matter separates more readily when fresh, and before the disengagement of any large quantity of gases, which, in stagnant reservoirs at a distance, would be great.

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\* A considerable portion of the soluble salts would pass off into the semi fluid sediment. A portion of the lower and denser part of the supernatant liquid might also, if necessary, be allowed to pass off through the shafts with the sediment. Of the value of this liquid there can be no doubt; the only question is the proportion which the cost of collecting it will bear to its marketable value.



With a diameter of about four feet, two lengths of about ten miles each of lower pipe or sewer might be laid down for about £132,000. The cost of the closed chambers, shafts, &c., would depend upon the quantity of matter discharged by each sewer respecting which data is wanting.\*

This plan is compatible with all possible amelioration in the existing system of sewerage; it does not separate the house from the street drainage; as, when mixed, their flow through the sewers is easier, the house drainage is rendered less offensive, and, in the absence of sufficient available resources for bringing masses of water through the sewers, the scouring afforded by rain water presents probably the best natural resource. The street dirt and smoke-saturated rain are probably not without their beneficial effects.

This plan admits of almost immediate application.

(The details are explained in the sections and drawings which accompany the paper).

(Signed)

JOSEPH PRESTWICH, Jun.

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JAMES PILBROW, Esq., C.E., F.S.A.

The sewage to be conveyed by an air-tight covered sewer to a certain and approved distance from the Metropolis.

That to prevent the *great cost* and *inconvenience* of altering both the direction and levels of all the existing sewers and drains, the present line, locality, and position of the great receptacle of all the sewage, viz., the Thames—is preserved.

The sewage will not be permitted to mix in any way with the water of the river, but to be conveyed along its bed, by large iron tubes, to reservoirs in the marshes of East Ham on the north, and Plumstead on the south; thereby securing all the advantages offered by the natural fall and depth of the river, without the disadvantage of contaminating its water, &c.

That, by placing this main trunk tube-sewer below the mud at *low* water mark, the present levels of the sewers' mouths, or outlets, may be materially and generally

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\* It is more than probable that the value of manure saved would not only pay the interest of the outlay, but also would contribute a considerable surplus towards defraying the annual expenses of the sewers, or towards the construction of new works.

improved by lowering them 10 to 15 feet. This, on the *Surrey* side, will be of incalculable importance.

The facility of completely flushing the whole of these tubes as frequently as required without any expense for water.

The use of air-pumps, to be worked by the engines at the reservoirs for drawing off the foul air and gases from the whole of the sewers, &c.

The avoiding any experimental works, or new element, in which we are not already practically experienced.

Avoiding all earthworks, cuttings, and tunnels, or purchase of properties or land, except a few acres in the marshes.

The chief outlay would be in an almost imperishable and intrinsically valuable, but ever convertible material.

The facility for alterations, extensions, and additions, with the least possible inconvenience and cost.

The objects—*simplicity, efficiency, and cheapness.*

(Signed)

JAMES PILBROW.

Tottenham,  
August 22, 1849.

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GEORGE REMINGTON, Esq.

*To the Metropolitan Commissioners of Sewers.*

My Lords and Gentlemen,

The plan which I have to propose for improving the drainage of London, consists in the construction of two main sewers, as shown by the red lines; the one commencing at Chelsea, and taking the line of the Thames to below Southwark-bridge, thence by Rosemary-lane, Cable-street, Back-lane, and Brook-street, by East and West India Dock-road, crossing the river Lea, near the Iron-bridge, and continuing in a direct line to Barking Level.

The other line commencing at Vauxhall, and following the south side of the Thames to Rotherhithe, thence by the Deptford-road, in front of Greenwich, and Woolwich, and terminating in the Plumstead Marshes, where, as on the north side of the river, there would be an extensive dépôt, with engines and pumps

for lifting, and basins for containing the manure. I propose the bottom of the sewers at Chelsea and Vauxhall respectively be the same level as low water line of ordinary spring tides, and that they should from thence have a fall of twelve inches to a mile, so that at Barking Level the bottom of the sewer along the north side of the river will be thirteen feet below low water mark. I propose the top of the sewer to be five feet above high water of ordinary spring tides throughout the whole distance, excepting at such places where it may be necessary to contract the headway for passing under the Slips, Docks, the Regent's Canal, Limehouse Cut, and River Lea, or any similar obstruction on the south side of the river as the Ravensborne, so that supposing spring tides to rise twenty feet, the internal height of the sewers at Chelsea and Vauxhall will be twenty-five feet, the height at Barking Level will be thirty-eight feet, and height at Plumstead Marshes thirty-seven feet.

I propose the width of the sewers to be twenty feet at the outfall, they may be less at the upper ends; but the drawings show the same width throughout, thus giving ample space to carry off all the present sewerage of London, and provision for the floods, or any increase that may arise from a more abundant supply of water.

I propose the sills of the respective outfalls to be the same level as low water mark, with proper sluices for keeping out the river water during the rise of the tide; it will thus be seen that the space tinted blue on the section below the level of low water, will become the receptacle for the manure as it settles from the sewerage water above low water level, and from which it may be taken by pumps from the end of the sewer, or from any other convenient points, and the upper water allowed to drain into the river with the falling tide, thus giving natural drainage to all but the manure after it has settled from the water.

I propose to provide an extensive basin on both sides of the river, for the purpose of containing the manure after it is pumped up from the bottom of the main sewers, and other basins and docks for the purposes of shipment, &c.

Although it may be desirable to carry out the whole extent proposed, it will readily be seen that a great part of London may be drained by terminating the north line at Plaistow Levels, and the southern line at Greenwich Marshes, which, as well as the cost, must be left for future consideration.

I have not given a section of the south side; that of the north side is more designed to show the principle than a correct section of the ground, which is impossible to give without further information.

I am, my Lords and Gentlemen,  
Your most obedient servant,

(Signed)

GEORGE REMINGTON.

11, Shaftesbury Crescent, Pimlico,  
August 10th, 1849.



*To the Metropolitan Commissioners of Sewers.*

My Lords and Gentlemen,

Having already written a report, dated the 10th instant, descriptive of my plan for improving the drainage of London, which report will be delivered herewith, I have further to add, that the two main sewers respectively, commencing at Chelsea and Vauxhall, may be extended to any desirable distance up the river.

Wherever the present sewers join the proposed main sewers, the foul air may be prevented escaping from one to the other by means of a proper system of dip pipes, or by turning down the ends of the present sewers; and the same principle may with good effect be extended to the street gratings; every grating should have a pipe attached to it with equal diameter to the grating, which pipe should descend down the gully-hole, and be made to dip into the sewer's water, or into a small well provided for that purpose; the same may also be extended to house and yard sinks, which would keep all the drains hermetically sealed, and the atmosphere free from contamination. It also appears necessary that there should be a more abundant supply of water continually running through the drains and sewers, which supply, if it cannot be obtained from any other source, may be taken from the Thames; and all the metropolitan markets, as Smithfield, Newgate, Farringdon, and others, should be supplied with fountains of water, for the purpose of carrying off the refuse. The adoption of the foregoing plan would make London clean and wholesome.

I am, your most obedient Servant,

(Signed)

GEORGE REMINGTON.

11, Shaftesbury Crescent, Pimlico,

August 16, 1849.

N.B.—The dip pipes may be conical or cylindrical, and made to seal themselves, by curving the lower end in the form of an inverted syphon.

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JASPER W. ROGERS, Esq.

Sanitary Engineering Offices,

88, St James's-street, London,

23rd August, 1849.

*To the Secretary of the Metropolitan Sewers.*

Sir,

IN reply to your circular of the 22nd inst., I have the honor to enclose, for the information of the Commissioners, a brief abstract of my plan for sanitary reform.

I propose, by the aid of peat charcoal, properly prepared, to consolidate and deodorise all feculent and pestilential matter, and to prevent its introduction, as at present, into the sewers or river.

The advantages which I propose to health, are too obvious to dwell on.

The pecuniary advantages are as follows :—

My plan does not entail an extensive and expensive alteration of the present system of sewage.

My proposition admits of being experimented on in a single locality.

By the plan which I propose, the sewers may be preserved for their legitimate use as mere aqueducts, and the sale of the manure, which will be of the most valuable description, while at the same time it will be quite dry, and perfectly inoffensive, capable therefore of transport, by any conveyance, in bags, to the most distant part of the kingdom, will yield a revenue, not only sufficient to cover all expenses, but leaving a margin of above £3,000,000. per annum, to the credit of the Metropolis.

I have the honor to be,

Your obedient Servant,

(Signed)

JASPER W. ROGERS, C.E.

JOHN BALDRY REDMAN, Esq.

5, New Palace Yard,

23rd August, 1849.

1st.—The separation of house from surface drainage, as far as the results of the Metropolitan Ordnance survey will show to be practicable.

2nd.—The extension and improvement of the existing sewers for the natural drainage of the metropolitan area (including street drainage under certain conditions), which, it is maintained, must ever be by the natural outfall—the river Thames .

3rd.—The construction of pits of deposit below the invert of existing sewers, near the new approaches, to arrest the heavier particles from surface drainage, the accumulations to be removed periodically by carts of the kind described, such refuse to be used for building or agricultural purposes ; also pits of deposit for ashes, dust, &c., &c., adjoining blocks of houses, with convenient approaches.

4th.—The re-formation of the streets (as repairs become necessary) as described, including water-traps to gulley-shoots of the self-adjusting form advocated, with sub-drains to carry off all water percolating through the pavements.

5th.—The formation of flood-gates at the outlets of sewers, and in intermediate positions of the formation described.

6th.—The construction of radiating main drains of discharge, from the centre of London to the suburbs; the connection therewith of branches on the plan proposed, to subserve house internal drainage alone; to be developed by a plentiful water supply.

7th.—The establishment of an urban boundary by the Board of Health, on the principles laid down in the Report, from the data furnished by the Ordnance survey; the removal beyond which of all noxious manufactures, and compensation made by a general improvement rate.

8th.—The formation outside this boundary of sanitary establishments with steam engines for water supply; drainage and subsequent sewage irrigation, together with disinfecting furnaces (if found requisite), to communicate with the domed tops of the settling reservoirs, and also to work the engines, &c.

9th.—The outfalls (natural by gravity, or artificial by pumping) to terminate in settling reservoirs; also the establishment of air valve posts, to keep up the draught, attenuated by the disinfecting furnaces, if such are used.

10th.—The formation of perpendicular standing mains, connected with the crown of the main radiating drains of discharge, where the same are deep below the surface, to afford greater facilities of connection with the house branches.

11th.—Presumed advantages:—the disinfection of the river; removal of cesspools; the distribution of sewage manure at convenient sites surrounding the Metropolis, instead of one or a few points, difficult of access for the rest of the suburbs; the perfection of the existing sewage system for its original and legitimate object, and the gradual developement of the radiating system of house drainage, by cutting off existing connections as new ones are effected, and the removal or filling up of cesspools as new areas of drainage are obtained; lastly, by obtaining points of discharge surrounding the Metropolis, the residuum of drainage which has not evaporated, and which has given out all the noxious but fertilising matter, returning to the Thames by various natural watercourses, whereas in any one main outlet, artificially created low down the river, the great volume discharged thereat must necessitate its quick transmission to the river, still highly



charged, although the heavier particles may possibly be arrested, and the river still contaminated, though in a less degree ; any outlet merely discharging the drainage lower down into the river, almost within the urban boundary, is but a diminution of the evil, and not a cure.

(Signed)

JOHN BALDRY REDMAN.

Messrs. ALEXANDER M. ROSS AND WILLIAM LOW.

3, Parliament-street, Westminster,  
21st August, 1849.

*To the Right Honourable and Honourable the Commissioners of Sewers for the Metropolitan Districts.*

My Lords and Gentlemen,

THE main features of our plan are as follow :—

Laying two cast-iron tubes, one on either side of the Thames, connecting them at two places—at Rotherhithe and Battersea ; bringing the whole soil to one general depôt at Bromley Marsh, thirty-five feet below the surface of the ground, contiguous to railway and water communication ; and getting rid of all waste in the Barking Reach at the *ebb-tide*.

The connecting these tubes with every sewer at present falling into the Thames, and in such a manner as not to pen back the sewage during high water ; *but allowing it UNINTERRUPTEDLY to flow in whatever state the tide may be in* ; the tubes being laid for the greater portion below the level of low-water, abundant facilities being afforded for storm and sudden floods.

Woolwich to be drained separately, on the same principle of obtaining outfall—an example of its applicability to every town on the banks of the Thames.

Whatever plan may be adopted for the inland, street, or house drainage of the City, whether done in part or in whole by one system or by several, it equally gives sufficient and perfect outfall to all at innumerable points easy of access along the banks, *completely freeing the river from its present impurities.*

Giving every facility for flushing any drain, at any time, irrespective of the state of the tide.

The channel of the river is adopted in order that a canal, below the level of low water, for laying the tubes can be dredged at a moderate cost, tunnelling at

such a depth being almost impracticable on account of the nature of the soil. The tubes being put together in long lengths, the river gives every facility whereby they may be floated, and lowered into their places.

At Battersea a pumping engine for distributing the soil for agricultural purposes would be provided. Similar facilities, by floating engines and barges, may be obtained at different points along the course of the river.

We are,  
My Lords and Gentlemen,  
Your very obedient and humble servants,  
(Signed)                      ALEXANDER M. ROSS,  
   WILLIAM LOW.

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FREEMAN ROE, Esq.

PURSUANT to the circular of the Court of Sewers, dated 22nd August, 1849, I would state that my leading principle regarding this question is to allow, as far as possible, the flow or outfall of the sewage of London to remain as it is, but to intercept it in its passage to the river, and conduct it to receptacles on the outside of the town, and there convert it into manure.

This interception I would effect on the northern or Middlesex side of the river, by laying on its bed, at forty or fifty feet from the shore, a continuous drain, terminating at the Isle of Dogs. And on the southern or Surrey side, by laying a similar sewer along the skirts of the town, between it and the higher lands in its rear, and conduct it through Deptford and Greenwich to the marshes on the East of Greenwich.

From this place I would continue a similar sewer to the east of Woolwich, to carry off the drainage of Woolwich, and to receive in its course the drainage of the district between that place and Greenwich.

One receptacle or dépôt would, therefore, be at the Isle of Dogs, and another at the Greenwich Marshes.

By the two branches of this southern sewer an efficient outfall would be at once provided for the drainage of the whole rural district to the southward, and the towns dispersed upon it; though, in carrying out this part of my plan, it would be requisite to turn the house sewage of the town area into my proposed main drain, while the existing sewers of that area were left to discharge the surface waters into the river.

In laying this main I would generally keep the main roads, going occasionally deeper for a short space, in preference to going to the right or left, to get at the lowest surface.

The fall of the main on the river's bed being restricted, I would insert cesspools under the mouths of most of the town sewers, as depositories for the more solid portion of the sewage (now forming the river's muddy shore).

My mains could be diminished in size in their course from the depôts to their heads, and the branch leading to Woolwich I would have less than the others.

I would prevent the deposition of sediment in existing flat sewers by putting cesspools under them at eligible places, first clearing the bottoms of the sewers of the soil that has lodged there, and replacing it by brickwork.

The silt and filth of surface washings I would keep out of these sewers by using the trap mentioned in the Report.

A part of the detail which cost me much consideration was the securing the works in the river from the water while they were in hand, but this I am now satisfied could be effected by a moveable caisson, put up in short pieces, and consisting of two lengths of 100 feet each.

The sides of the trenches, both in the river and on shore, I would secure by benchings and shorings.

My object has been to economize, by making as much use of existing provisions as I could. The greatest infraction of this principle is the providing house drainage for the Surrey side of London, requisite from the position of my main sewer, and counterpoised, I hope, by the facility afforded for draining the whole rural district.

(Signed)                      FREEMAN ROE and HANSON,  
70, Strand, and Southwark Iron Works,  
Sumner-street, Southwark-bridge-road.

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MESSRS. RUMBALL AND SHEPPARD.

The distinguishing characteristics of this scheme are the following :—

First, as regards the north side of the river, it is proposed to form an annular sewer, of about sixteen feet in diameter, at a sufficient level below Trinity high-



water that the outlets of the existing sewers may be connected by radial branches from the annular sewer.

*Direction of Annular Sewer.*—The direction of this proposed sewer would be as follows:—Commencing near North End, Fulham, passing through Shepherd's Bush, between Kensall-green and Paddington, Paddington and Portland Town in the west; Primrose-hill, Islington, and Hackney on the north, and by Globe Town, to West Ham, in the East, and terminating in the Barking Marshes.

*Outfall.*—The outfall for the solid part of the sewage is in proposed tanks, in the Barking Marshes, which tanks would be constructed at different levels. After the greatest quantity of fertilizing matter is abstracted from the sewage matter, it will be conveyed to a point on the shore, where the ebb tide is certain to carry it off to the sea.

*Surface Drainage of the Country received into this Sewer.*—This annular sewer would receive all the drainage from the high lands, and so prevent it passing through the town in its passage to the river, forcing up the sewage, as is often the case during heavy rains, into the basement floors of houses in the low districts.

*Country Drainage.*—The drainage from Staines, Hounslow, Isleworth, Brentford, &c., will be brought into this annular sewer at North End, Fulham, by means of a smaller culvert.

*Drainage on the south side of the River.*—Secondly, as regards the drainage on the south side of the river, it is proposed to construct a culvert, of about ten feet diameter, at a lower level than any of the mouths of the existing sewers. This culvert would commence near Battersea, passing by Camberwell, Deptford, Greenwich, Woolwich, beyond which place the contents would be received into tanks, and a cut made to a convenient point of the shore, for the discharge of the surplus sewage water.

To bring the drainage to this culvert branches to the Thames will have to be formed.

The drainage from the towns on the Surrey side of the river would enter at Battersea, by a smaller culvert, connecting the different towns.

*Flushing.*—That as a plan for the permanent drainage of the Metropolis must be considered imperfect unless due regard be paid to the proper means of flushing, it is proposed to bring down a supply of water for that purpose from the river Thames, near Staines. The water being received into reservoirs, on both sides of the

river, and applied at different points of the sewers, so as to obtain an effectual cleansing of the same; at the same time a large quantity of pure water will be available for domestic purposes.

*Street sweepings not to enter the sewers.*—It is intended to exclude from the sewers all the comminuted particles of granite, gravel, &c., brought in by the surface drainage, which, forming a hard deposit, causes obstructions to the flow of the sewage: and this will be effected by a peculiar construction of trap.

*Ventilation of Sewers.*—That, as it is most prejudicial to the public health to continue the practice of making the gully-holes the outlets for the effluvia arising from the sewers, it is proposed by this scheme to ventilate the sewers by the use of the steam jet, as at present so successfully applied to the ventilation of mines, bringing into shafts all the destructive gases, which are now allowed to escape by numerous gully-holes into the atmosphere, spreading contagion around.

*The preservation of the Manure provided for in this scheme.*—That the entire preservation of the fertilising matter contained in the sewage water is intended, and for this purpose receiving tanks will be formed. The sewage water, after the abstraction of the solid parts, will not be allowed to enter the Thames, only at such points when the ebb-tide is sure to carry it to the sea; because if the sewage water is allowed to enter the Thames where it is at all likely to be influenced by the flood-tide, the good effected by the exclusion of the contents of the existing sewers will not be complete.

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R. RETTIE, Esq.

Aberdeen, 25th August, 1849.

*To the Metropolitan Sewers Commissioners, &c. &c.*

My Lords and Gentlemen,

AGREEABLE to your request, I send you a concise statement of my plans, which I proposed to lay down (nearly ten years ago) as a superior method of draining and sewerage the city and suburbs of London.

In my work, published on "*Marine Night Signals*," in the year 1846, I enumerate *various improved methods*, whereby greater security is obtained in preventing the egress of all effluvia and noxious gases, or vapour, &c., arising from the decomposing or putrid matter contained in the stagnant sewers of London. Some eighteen months ago I also gave a report (which I read before the City Commissioners at Guildhall) showing that much of the "*fever*" and "*malaria*," and "*cholera*" (should

*it appear), might be avoided!* My Report, which was handed by Deputy Peacock, after I had read it, to the Surveyor, with “*a remark of approbation*” as to its value, but the report was thrown aside, and the *truths contained therein*, and the *improvements suggested*, were *unheeded*, and the consequence has been that *many have fallen victims to the indifference of those whose duty it was to have aided the Commissioners in carrying forward* those useful improvements so necessary and beneficial for the *public health*. The plans I now lay before the Metropolitan Commissioners consist of a great variety of improvements, *throughout the various branches of the sewerage question*, for the “*public streets*,” “*private houses*,” &c. &c.; indeed, it would be futile to advance any SINGLE IMPROVEMENT, or expect that it would enable the Commissioners to carry out such an extensive and varied national undertaking; and those parties, either at the Board or out of the Board, are *not the friends of the public*, who would either encourage or foster any *single scheme*, or *schemer*, who may bring forward “*a Utopian plan*” for *one solitary part or portion*, which may be the means, perhaps, of retarding and upsetting the whole system; and it appears to me that the greatest difficulty the “COMMISSIONERS LABOUR UNDER” is the want of a first-rate “WORKING MAN,” EXPERIENCED IN “SCIENTIFIC KNOWLEDGE,” “PRACTICAL MECHANICS,” and, in fact, ENDOWED WITH GREAT GOOD “COMMON SENSE,” HAVING A MIND OF HIS OWN, and CONSCIOUS OF BEING ABLE TO CARRY OUT, UNDER the guidance and direction of the Commissioners, or Secretary, Mr. Chadwick, a series of important inventions and improvements, which is absolutely necessary in this great undertaking. He must not only be FIRM and DETERMINED, but also INDEPENDENT OF JOBS OR JOBBERS, CLASSIFYING, and LAYING DOWN WELL-MATURED PLANS, and SEEING THEM CARRIED OUT, WITHOUT DELAY OR UNNECESSARY EXPENSE!!!—free and UNFETTERED OUGHT HE TO BE—“IN DAILY COMMUNICATION WITH THE BOARD,” to show his plans of operation for the day, and then left to keep the various subordinates, and those under them, at their several posts, *for however well the COMMISSION may be carried on* and conducted, and even with *unlimited means*, I feel assured that unless they, the Commissioners, are supported and aided by such a person, “who can carry out these views, as now laid before you, and the Commission *not to be* “*thwarted by a remnant of the old regime*,” AS THEY HAVE BEEN, it will be a long time indeed ere the work be carried out and finished, either as regards pleasure to the Commissioners, or the advantage of the public welfare.

*Mr. Peacock  
inc.*

I now beg leave to lay before you the main features of my plans, in as concise a form as I can, *dividing it into two parts*, relating to *public* and *private* purposes, but it is impossible to go so fully into detail from the great length of the necessary observations, and the shortness of the time you have given me to do so. And—

*First.* As regards the public department, the thoroughly eradicating of ALL “EFFLUVIA” from the “*sewers*,” and “*general drainage*” of the city and suburbs by “*air-tight mains of cast-iron, or strong glazed earthen-ware pipes*” (not brick).



*Second.* The ERADICATION and shutting up of all CESSPOOLS, and attaching BRANCH TUBES into the main sewers, which have hitherto *destroyed* the *atmosphere*, *saturating* the *subsoil*, and rendering the whole city and suburbs the hotbed of fever, (unless they are permanently built of stone or asphalte, and covered properly up).

*Thirdly.* The abolition of the present PUBLIC URINALS, as they now stand, which, from their "*horrid stench*," renders them scarcely *useable*, and may be put up in a *different way*, in *six times* the *number*, at a *tithe* of the *expense*, and PERFECTLY FREE FROM ALL SMELL OR EFFLUVIA !!! and MORE DURABLE.

*Fourth.* The immediate closing up of the "AIR HOLES," lately fixed in the middle of the streets, WHERE THE EFFLUVIA IS CONTINUALLY POURING FORTH, TO THE DESTRUCTION OF THE INHABITANTS, shewing the want of intellect of those parties who had caused them to be opened, the expense being great, but nothing in comparison to the SACRIFICE OF LIFE that has ARISEN, but may even NOW BE MADE USEFUL, by mechanical appliances, for the cleansing of the sewers.—BUT THEY MUST BE SHUT UP !

*Fifth.* "THE RESERVOIR SYSTEM," with "self-acting sewer trap," "preventing streets being shut up, traffic impeded," and enabling the refuse soil from being carried through, so *as to choke up the main sewers and drains*, being an improvement, for the extracting of the contents, without disturbing or annoying the public (AND REQUIRING NO UNNECESSARY STEAM BOILER TO DESTROY THE SMELL), being fitted up with an apparatus, IF REQUIRED, which empties the contents in a few minutes, by *night or day, without any smell*, by a simple mechanical contrivance.

*Sixth.* The MAIN OR BRANCH SEWERS, to be of IRON OR FIRE CLAY, GLAZED, NOT BRICK, as they are so liable to give way, and *saturate the surrounding earth*; and, the one being much cheaper than the other, and far more enduring, without creating effluvia, and preventing all chance of saturation of the subsoil.

*Seventh.* The shutting up of all "SEWER GRATINGS," "WATER LUTEING," and "SELF-ACTING," made so as they may be put down or taken up, if necessary, for repairs, in a few minutes, *without shutting up the streets, or impeding the traffic during repairs*, which is a dead loss to the public.

*Eighth.* The carrying of the *grand trunk sewer, or tube*, of iron, "*four feet in diameter*," *along the Thames, or under the tidal bed of the river, for the refuse or soil, to some convenient spot on the banks or marshes, where it may be stored up, and formed into blocks, by machinery, made for the purpose*; so that these *blocks of manure* may be sent by "*river*," "*railway*," or "*shipping*," &c. to any quarter of the country, where they will bring their value; and, when so manufactured, *will*

*yield a return equivalent* to the money which you have laid out: nor is this all, for it will create trade and bring wealth, where formerly it was lost, and was wasted in the ocean.

*Ninthly.* THE LIQUID MANURE, or ammonia, which has been extracted during this operation of converting these blocks, may also be put into casks, and sent off in a similar way, yielding a handsome return.

*Tenth.* "THE IMPROVED GRATINGS," for preventing all escape of effluvia, and air traps, are also applicable for "*domestic SANATORY PURPOSES*," as well as "public streets," being self-acting, without requiring any attendance, and are now made of "IRON," "LEAD," "BRASS," or "EARTHENWARE."

*Eleventh.* Let it be understood that these "LARGE RESERVOIRS"\* are placed in DEAD LEVELS, *where sewerage cannot be effected*, so as to join the *inclined* or *main sewers, direct towards the river!* the *smaller reservoirs will be serviceable*, where it would be *too expensive* to continue unnecessary sewers to any uncalled for distance; and will enable a more efficient drainage to be accomplished, *free from all smell*, and purify the atmosphere, when otherwise it would have been left to stagnate, to the annoyance of the citizens.

*Secondly.*—AND AS REGARDS HOUSEHOLD DRAINAGE OR SEWERAGE—

*First.* All *overflow* or *surface water*, rain, should be kept from entering the soil pipes, or large sewerage mains.

*Second.* Sufficient sized soil pipes of lead, iron, or clay, glazed and burned, ought to be in every house, duly trapped, as they enter the main sewers.

*Third.* "Sufficient sink boxes," with proper "taps"—"gratings, trapped" in the bottom, and "overflow pipe," and "grating" besides, so that no refuse can get into the main pipe, which might be filled up or choked.

*Fourth.* "Traps" at *each house main*, for the "exclusion of effluvia" carried from the main sewer into the house. *None of the above improvements are yet introduced into London.*

*Fifth.* All "*water closets*" ought to have "*sufficient sized soil pipes*," and also duly "trapped" as they enter the "main sewer," for it is from these sewers that so

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\* These large reservoirs to be erected near or adjoining railway stations or shipping ports, that they may give facility of transporting to the country districts.

much disease is engendered, by *openings left untrapped from the sewers into private houses, hence the inmates are continually breathing an impure and poisonous atmosphere, unconsciously but surely to the destruction of their health, when by simple means all this might be avoided.*

*Sixth.* THE ABOLITION OF ALL CESSPOOLS—THIS IS ONE OF THE GREATEST EVILS IN LONDON—far worse than the closets—the removal of these horrid nuisances—“*stagnant steaming cauldrons,*” continually vomiting forth with *fætid odours*” into the houses almost in every quarter of the city and suburbs—ENGENDERING MORE “FEVERS,” “CHOLERA,” and “DISEASE,” THAN ALL THE OTHER EVILS PUT TOGETHER, in fact, this is one of the greatest nuisances, WHICH MY PLAN OF SEWERAGE COMPLETELY ERADICATES, AND RENDERS ENTIRELY INNOCUOUS, AND FREES THE PUBLIC BY A SYSTEMATIC ARRANGEMENT OF THE SEWERS, making them one continued “AIR-TIGHT SYSTEM;” and in thus abolishing of the “cesspools,” by means of various cheap and efficient “mechanical arrangements,” that are to be applied and put into use under my advice, or by any, even a common labourer, these may be properly carried out, and being led into the grand trunk main, will form, from it being so arranged, a complete self-acting principle, by drawing the air through the sewers, until it is discharged at the main outlets, far away from the city, which alone can be perfectly accomplished by an air-tight system of sewerage, the same as gas mains or water-pipes—there should be no difference.

My Lords and Gentlemen, in conclusion, I have endeavoured, as concisely as possible, to give you a faint idea of the system I propose; but without going more particularly into detail, which I am unable to do, to do justice to you and myself on such an important subject as the drainage of the city of London, it would require a work published with diagrams of all the various appliances which might be necessary, according to the heights and distances of the various sewers in the different localities, and also the proper falls and levels, &c., but the general outline or plan, as now given by me, may be carried out by any person whom you may appoint, with ease and economy, in a thoroughly efficient manner, so as to completely eradicate all pollution of the atmosphere; and the same may be completed by your own workmen, employed by the Commissioners, and I feel assured, if it be fairly gone about, that the expense will not exceed, in the completion, £50,000 sterling, with the addition of £10,000 for the main trunk leading to the marshes; and for this sum sewers, gratings, and branches, and removal of cesspools and public nuisances, and such like, may be ultimately done away with, and the whole sewerage of the city put in efficient condition; but remember this calculation only applies to those works publicly belonging to the Board, as all private improvements connected with household property ought fairly to be paid by the proprietors thereof; and it is to be regretted that so much delay has taken place, that parties have been divided in opinion, one



against the other, and that jarring interests clashing and preventing, for years, one of the most necessary improvements from taking place—the purifying of London, the grandest triumph of science and of art to clear away this deadly scourge, which rankles against the health of the rich as well as the poor, and that, in doing this, you will remove a great evil and secure also certain gain, for what is now prudently expended will yield a fourfold return in future, while your polluted atmosphere will vanish, and the putrid filth will disappear, and give a new branch of industry to many out of labour, in the converting of these masses of filth, which, to the thoughtless, as dross, but to the right-thinking, who can appreciate, as stores of wealth, which has been borne, polluting as it passed, in our noble river into the ocean and lost for ever, the health of our inhabitants suffering for the neglect of those who despise the aids of science and of art, by which these manures could have been solidified into blocks, and exported throughout the world by our numerous shipping; while the liquid ammonia might have been preserved to invigorate and enrich our barren mountains or our sterile acres, which lie waste and uncultivated, when we are sending those labourers, countrymen of our own, far away, in poverty and penury, to do that work which they could find at home.

This is no Utopian theory, it is the views of one that knows that it can be carried out to the letter, and enrich those connected with it. The Board may find difficulty in finding those capable, though, in the busy ranks of industry, there are those willing to embrace and carry out, with the advantages of knowledge, combined with the multifarious improvements and inventions which science and the mechanical arts do afford, and will turn them to account while carrying out these extended operations. And the Commissioners will find that, unless they are assisted by a genius of universal knowledge, similar to *Brunnelle* of old, or some such general leader, who planned and formed the block machinery at Portsmouth, to guide and direct you in this great undertaking, to make judicious arrangements, to classify and lay down a systematic division of labour, the Commissioners will toil and labour in vain, and the work will go but slowly on, and anything but profitably, just like an army where they are all generals or privates, the victory will be lost.

But you need not despair, your cause is good, it is simple, there are no difficulties in the way but what may be overcome by concentration of ability, without which nothing can be gained, especially in an undertaking so general and so varied in its nature and requirements, which must and will occur, according to circumstances. Such is the opinion, my Lords and Gentlemen, of your obedient servant,

(Signed)

R. RETTIE, C.E.

WILLIAM RADLEY, Esq., Chymical Engineer,  
ON THE GENIUS AND USE OF CLOACAL APPENDAGES TO THE SOCIAL ECONOMY  
OF TOWNS.

*To the Metropolitan Commission of Sewers.*

My Lords and Gentlemen,

To indicate to your Commission the nature and objects of a complete system of sewers and street drainage, and to instance some new but important ideas in connection, and more especially in obedience to your circular of the 22d instant to me addressed, I beg to forward this communication.

It is commonly avowed, that "A large town is a great evil;" but all will agree, that with an efficient adaptation of cloacal arrangement, and embouchure, a large town may be more convenienced than a small one, by this important adjunct to civilisation, just as large machines cost less in proportion, and are worked more economically than small ones.

This subject divides itself very naturally into the physical and dynamical, and whilst engineering and constructive functions are referable to the latter, it is the former branch that I propose more particularly to entertain, briefly adverting that since the actual structure of cloacal conduits finds a ready expletive in the details of this kind of work, still extant in Roman structure, embodying as it were unwittingly or intuitively, the observations of Gennetè, based upon the sublime and simple structural functions of arterial and venous conduits, no difficulty need be anticipated on this important head of the subject.

I need not occupy your time with a recital of the intentions of sewers, further than to insist upon the facts, that as a great difference exists between the various kinds of cloacal contents, and the structure depends upon, and ought to be in strict keeping with the uses of the receptacle, it is obvious how important it must be in such an inquiry as the one which now engages your attention, to understand well the chymical and physical relations of the subject, in order not only to attain the object sought, but indicate to after times that such constructions were based in a scientific, consistent, and well understood rationale.

Extensive investigations made into the incipient, progressive, and ultimate natures of the *contents and colouring matters of sinks and drains* in the abstract, and as an element to an efficient rationale of vicarious or topical contagion, in its capacity of predisposing to, or exciting the developement of morbid influences in the bodies of men and the lower animals, and materially aided therein by a careful perusal of "*M. Edwards's Traité sur la Vie*," and similar works, I have been irresistibly led to the belief, that "animal life does not immediately cease with the apparent death, the vital principle being actually and continuously existent with

downward tendency, from the highest to the lowest forms of physical condition, wherein the blood and lymph discharge organic functions cognate to each other. Hence from blood and lymph, the *vehicles of life*, a vast and numerous progeny of sporal animalcules, incessantly spring forth, until their source is xymotically extinct, which (like to gluten-synaptase and diastase, exert their characteristic influences upon all organic matter, dead or living, resembling fecula of grain, or the animal pabula of proteine, caseine, fibrine, or albumen) are susceptible of xymotic metamorphosis, whence germs of morbid influence poured forth by millions attain the air, infesting human food and drink, and bringing up from time to time the ever varying types of endemial, epidemic, and contagious disease."

It is a fact beyond dispute, that flesh and carcases, containing blood and lymph, as well as these in a separated state, are far more active agents in determining the rôle of vigorous health, than all the rest of sewage filth, whose abonde and tone-destroying emanations are merely operative of defect of vital energy, by indirect reduction of the proper volume of vital air within the vital ærospheric medium, or when superabundantly infused upon the atmosphere, produce asphyxial tendencies.

Thus, then, for sewers to be efficient, it is important that a separation of their contained matters should be effected, continually in its route, with reference strictly to the anticipation of the production and evolution of septic and sporal emanations, to the complete exclusion of all care about their preparation and collection for agricultural purposes.

The entrance of carcases and flesh suffused with blood, as well as blood and lymph in a separate state, from animal slaughteries and hospitals, into the cloacal conduits, must be rigidly and fully prohibited and prevented, and then it will become the easiest thing imaginable to deal with the sources of merely septic or asphyxiating vapours.

It is doubtless part of the same wise Providence that makes *evils antithetic*, that *a substance to be had for next to nothing* exists to superabundance, and continually produced within the precincts of every town, *which, by the simplest form of application, is competent to defæcate the* (step by step progression of) *sewage* in its conduits, so as to annihilate those noisome emanations which *soak* the ground to a frightful degree, about the sewage conduits, escaping thence, or by the traps and gullies, to taint, dilute, and rob the air of its vivifying componency.

For this and the general purpose of sewage provision, I am ready, under sanction of the usual privities and guarantee of benefits to be derived, proportionate to the value of my communications, or extent to which my proposals are made use



of by the Commission, to propound a remedy for this mighty evil, that shall be at once both simple, efficient, and inexpensive.

Before I quit this subject, I may, without invidious suspicion, be permitted to drop a few remarks anent the projects for deodorizing sewage *filth*, as a preliminary to, and with the view of its conversion to forms of agricultural *Tilth*.

We know that whatsoever deprives a substance of its aqueous solubility, restrains its faculty of molecular decomposition; and as all *Tilth*, to be a fertiliser, must thus be soluble, it follows that the processes of Ellerman, Dover, and others must in this respect be both futile and fallacious, because by them the soluble is converted to the state of various insolubility, whilst those other projects, of which Mr. Phillips and the Sewage Manure Company are the types, escape this glaring fallacy to tumble, neck and crop, into others of endemial character and septic tendency.

Although it will be wise to make provision in the sewage structures, to defæcate and gradually deodorize the sewage current, it yet will be both fallacious and unwise to accomplish this important end, merely as an element to agricultural economy, because to such a purpose the defæcated filth is little applicable, and the sanitary intentions will be but ill sustained wherever they are made to play a subordinate part.

With the assurance to your Commission, that "in the multitude of counsel there is wisdom," and as part of this counsel, I assuredly can communicate some highly important matter, the result of years of patient attention and observation, I beg to subscribe myself,

Your most obedient servant,

(Signed) WILLIAM RADLEY, Chymical Engineer.

Loetschen Smelting Works, near Turtmagne, Canton  
de Valais, Switzerland, August 25, 1849.

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WILLIAM STEWART, Esq.

*To her Majesty's Justices and Commissioners for the Metropolitan Sewers.*

Gentlemen,

I should not have presumed to offer any observations to you upon the drainage of the Metropolis, if I had not seen your invitation, open to all, to tender plans for that purpose; and knowing the vast importance of the subject, particularly

when it seems necessary, and is quite expected by the public that some new system should be adopted. I think it then becomes every one who feels interested in the subject, and thinks he can throw a modicum of light upon it, to do so, as a wrong step at this time would be very unfortunate.

If the views herein laid down should contain any hints worth acting upon, I have no doubt they will be adopted, and therein I shall feel pleasure in having been a contributor. If, on the contrary, they should be totally rejected, I shall still be satisfied, having confidence that better plans will have been preferred; at any rate amongst many plans some good ideas may be gleaned.

The objects hereby designed to be accomplished, and which I will suppose are identical with those which the Commissioners desire to attain, or nearly so, are the following, viz.:—1st. To drain in an efficient manner all the lower districts surrounding London. 2nd. To convey away all the sewage matter to the marsh lands below the Metropolis. 3rd. To prevent, as far as possible, the house drainage and other offensive matter from increasing the impurities of the river. And I may add, to accomplish the foregoing at the least possible expense. I must premise, that I am totally without data as to *particular* levels in the different districts, my chief guides being the line of high water, the fall of tide, and such other observations as I have made by living in this place, and a slight acquaintance with the Tower Hamlets sewers. My design is divided into two parts, call them Nos. 1 and 2. No. 1 is intended to take all the sewage on the Middlesex side of the river; and No. 2 to take the Surrey and Kent side. I will here give a short description of plan No. 1, which will be sufficient to show the system for both.

On the red line drawn on the map sent herewith (or on any other line having nearly the same termini, and which upon examination may be considered to be more eligible), I would construct a culvert, of sufficient capacity to receive all the sewage on this side of the river, of parallel width throughout,—five feet wide would probably be ample. The bottom of the culvert at the lower end should be at some little distance from the river wall in the Plaistow Marsh, but to which my map does not extend, and down to within two feet of the level of low water. The bottom at the upper end should be low enough to take the lowest sewage of Westminster, which I suppose and believe would leave a difference of level between the two ends of about four feet. This may seem a slight fall for eight miles, but I trust I shall be able to show hereafter that it is quite sufficient. The crown of the culvert should be at least as high at the lower as it is at the upper end, thereby leaving the sewer higher at its outfall, by the difference of level in the bottom. Ventilating shafts may be disposed in suitable situations along the line, and made ornamental objects if thought desirable. The mouth of the sewer I would enlarge to a circular funnel-shaped chamber, with a flat bottom or apron, affording room therein for the formation of entrances into three or more reservoirs.

The reservoirs should be sunk two feet below the outfall of the sewer, with sluices to each, so that the sewage may be made to pass through the reservoirs alternately. At the outer end of each reservoir sliding sluices or paddles, at different heights, should regulate the flow outwards, leaving the sediment in the reservoirs, to be removed by any simple means. The outfall from the reservoirs should be into a chamber, of similar shape to the other, from which a culvert of cast-iron should run out into the tide way below low water mark. Any quantity of water may be taken from these reservoirs, if required, for agricultural purposes, as well as the more solid sediment in the bottoms of them, and the remainder passes into the outer chamber, into which also the tide will flow, and as it recedes it will be carried *down* the river.

This sewer may be flushed out at low water by a very short lift of water from the river, at the upper end, but I think will seldom require it; so that there will be no working expenses for drainage purposes to the level of the water in the river, and it is clear that this is all that is attainable by any plan whatever, without the assistance of power to lift the sewage water above the level of the tide. If that is necessary sometimes at the top of high tides, a small engine is all that will be needed for such purpose, the lift in this case also being very short. Trifling alterations in those portions of the old sewers which lie between the proposed work and the river will serve to drain those districts; the other parts will require only to be connected with the new work, but may be trapped if necessary, and the old outlets may be left open, to assist in the more rapid discharge of water occasioned by storms. &c. I will neither underrate nor magnify the difficulties that would have to be encountered in the execution of this great work, but they are all perfectly practicable, and comparatively easy, when contrasted with other plans which have been made public.

The mode of constructing the above culvert, which I would recommend, is by careful tunnelling nearly throughout; and although I would prefer the line marked on the shore of the river, yet, for many reasons, I think it unlikely to be chosen. This sewer would be chiefly in the upper part of the blue clay, a substance which I need not say is of a very tenacious nature, and one of the best soils for such a work, to be carried through. And by this method you will avoid all obstructions by the old sewers, pipes, foundations, &c., by being far below them, besides the great public inconvenience and expense of breaking up the streets.

Slight iron shields of four compartments each, constructed after Sir Isambard Brunel's admirable example, would "make assurance doubly sure," and would be easily worked; and the Regent's Canal and River Lea, and even Bow Creek may, in my opinion, be safely passed in this way, the narrow face of the excavation being highly favourable to safety; and if tunnel works are carefully done and soundly pinned up over the arch they may be carried under almost any building at this depth with perfect safety, and the expense of construction would be far less, and the



works and buildings far more secure than if done by any other method. We have seen in our time a tunnel of more than ten times the sectional surface required here carried through under a great river, and under circumstances infinitely more dangerous in every respect, and brought to completion under difficulties without parallel. I therefore hope that this will not be laid aside without due consideration, or on account of the difficulties to be encountered.

I remain, Gentlemen,

Your most obedient servant,

(Signed)

WILLIAM STEWART.

Limehouse, August 4th, 1849.

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J. PIGOT SMITH, Esq.

Town Surveyor's Office, Birmingham,  
August 23d, 1849.

Sir,

IN conformity with a resolution of the Honourable Court of Sewers, I beg to hand you a concise statement of the main features of the plan of drainage for the Metropolis I had the honour of submitting to the Court on the 20th instant.

I propose to lay down on both sides of, and in close proximity to the river Thames, intercepting sewers. The one on the north side to commence at the Plaistow Marshes, and terminate at Brentford. The one on the south commencing at the Plumstead Marshes, below Woolwich, and terminating at Richmond.

Both mains to be laid below all existing sewers for the purpose of intercepting the sewage. The rain-fall or flood-water I propose, by means of self-acting gates or shafts (as the case may require), to pass directly into the river; I thus preserve all the existing sewers, and give additional facility to their discharge.

Both mains to be of one uniform gradient, except on the curves, which I propose to "ramp," so as to insure the same velocity as if in a straight line.

The size of each main at its commencement to be 7 feet by five feet 6 inches, gradually reduced to 4 feet 6 inches by 2 feet 3 inches, to be composed of 9 inch brickwork, of a modified egg shape.

Every yard of each main will be available for house drainage, so that not only will  $39\frac{1}{4}$  miles of main be provided, but the same extent of sewer, available for all

sewage purposes, carried through the lowest levels, and the very worst drained portions of the Metropolis, and throughout their entire route passing along the public thoroughfares, avoiding compensation and other expenses incidental to works carried through private property.

The main will be constructed without any interruption to the traffic on the City side of the river.

Reservoirs and other works to be constructed on the Plaistow and Plumstead Marshes, for the purpose of collecting, precipitating, and solidifying the sewage for agricultural purposes.

The cost of the whole of these works I estimate at £492,000, and to be completed in three years. In laying down the above plan, I have followed the route pointed out by unerring nature, and in strict accordance with the system I have laid down, and to a very considerable extent carried out in Birmingham, which has been examined and approved by the most eminent engineers; and I am confident, as regards the Metropolis, will prove the most efficient and most economical.

I am, Sir,

Ever your obedient servant,

(Signed)

J. PIGOTT SMITH,

Surveyor and Engineer to the Commissioners  
of the Birmingham Street Acts.

To E. H. Woolrych, Esq., Secretary to the  
Metropolitan Commissioners of Sewers.

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JOHN SUTTON, Esq., C.E.

42, Stamford-street, Blackfriars-road.

THE MARGIN SEWER.

*To the Right Honourable and Honourable the Commissioners of the Metropolitan  
Sewers.*

HONOURED SIRS,

I BEG leave most respectfully to draw your attention to my plan, which, among others, will embrace the following benefits:—

The entire preservation of the Thames river water from every kind of pollution.

The reclaiming of the present waste border land, or margin of the river Thames, amounting to many acres of good profitable land, or river frontage.

The destroying the exhalations arising at every ebb of tide from the accumulations of filth left bare by the waters receding.

A creating a river-side promenade in certain parts.

And the edging in the river Thames so as to form a Gigantic Margin Sewer.

Gentlemen, with your permission, I will pass over the introductory remarks of my former plan, and come to the main question at once.

I would have formed all along the margin of the river Thames (cutting off as much as possible the extreme outside curves, by passing in a straight line from one point to another), a vast commodious sewer, say the Middlesex side of London first, the Surrey side to follow in due course. This sewer I would construct thus: I would drive suitable prepared piles down, say about three feet apart, running in a straight line from point to point along the margin of the river, keeping as far off from the present edge as possible—I mean the ground that is at present left bare by the reflux of the tide. Now these piles being thus driven in, in a straight line, I would then have affixed thereto galvanised sheet-iron placed perpendicularly on the outside of the piles facing the river, and the same on the inside of the piles facing the shore, taking care the sheet iron is of sufficient length to reach from two feet above high-water mark to a suitable depth below in the ground. Now these sheets of iron can be rolled or flatted to the size necessary to cover so many piles, and as each sheet will be, or rather should be, a quarter of an inch thick, I need not say it will be firmer than any brick or stone wall, and last for ages. Now the space in between every two piles may be filled up with concrete, &c., well rammed down; and if this facing, which will be more than a foot thick, be thus done, it will be thoroughly water-tight, and proof against any wear or tear, and which may be carried on uninterruptedly for many miles. Now by this simple means we may commence edging in the river, if I may so say, in order to carry out more fully our ulterior views. This I would do at first, say from Vauxhall-bridge to St. Katherine's-dock, for here we must alter our mode so as not to interfere with the ingress and egress of the shipping. This must be done at every dock; the manner I will show anon. Now this aforesaid edging-in must be continued onward, down as far as, say Woolwich for the present, but further on when the main portion is complete. Now, when we have thus edged in the river as far as St. Katherine's docks, we shall then be in a proper condition to construct, easily, a gigantic tubular sewer, as we shall not be interfered with in the least by the water of the Thames, as by temporarily damming up each end on any portion of this enclosure we shall have a water-tight coffer-dam of such length as may suit our convenience. Now, I should say, form a similar one exactly parallel thereto, viz., in shore, say about nine feet from the outer one; this, with a depth suitable to the present sewers running into the



Thames, will give a fair size for the sewer above Blackfriars-bridge; but below I think we must have it a little larger; but this is open to correction. Now I think I have explained sufficiently to show we have two upright walls, facing each other, exactly alike; the next we have to do is to form a floor or bottom to it. Here, again, we must have recourse to timber properly prepared by Ryanising, &c., and covered with galvanised sheet-iron, similar to the sides. Now thus, with the flooring added, we have a beautiful formed sewer, capable of carrying off the whole of the London sewerage. And now all we have to do is to roof it, and over it we may have a promanade, &c., or else go towards extending the frontage of the various wharfs, &c. Now I need not say, that in between this sewer and the main land must be filled up and made level therewith; and thus we shall have a bold square frontage all along the river; and if this is painted white or green, the aspect of the river will be magnificent. Now I have given the shape, and what it should be formed of; and, as regards cheapness, it beats every thing else on that score; and as for strength, it will last for ages. It will be observed, that this plan entirely prevents any particle of filth flowing into the Thames, as it intercepts every thing all along its banks. \* \* \* \* Besides, my sewer will be so constructed as to cause it to be flushed out twice every day, as I purpose having, at its entrance up the river, a kind of flushing portcullis, so that at a certain time of high water the entrance flood-gate may be raised by the means of a float, which, on rising, will cause the water of the Thames to rush headlong, sweeping down the main sewer throughout its whole length, carrying every thing before it: thus we shall have the main sewer thoroughly washed out twice every day by a flood of water truly astounding, and that by such very simple means. Now this idea is so exceedingly good, that I must be excused if I say a few words on this point. It will be observed, that by this violent flushing we shall always be able to dislodge every kind of filth, however ponderous it may be, that has any inclination to lurk about this main sewer. \* \* \* \* \*

Now, the next point to be considered is, how shall we pass by the front of St. Katharine's Dock, London Dock, West India Docks, and East India Docks. Now, it should be borne in mind, that the higher we go up the river, the greater inclination or fall of water do we have down the river; as in one instance, we have a fall of near fifty feet in twenty miles. Now this is considerable, and is such as to back us in carrying out our views in passing these entrances. However, there will be nothing to prevent us undulating this sewer, where occasion may require, from this twofold reason:—First, that we have a *head-water*, some miles up the river, of a *greater altitude* than where these docks are situated. Secondly, that at the very time it is becoming *high water up the river*, where my main sewer commences, the tide is *fast refluxing where these docks are situated*; the consequence is, we shall have the advantage of a double inclination of the river, which will cause the water, when let in through the head entrance of the sewer, to possess a very great fall throughout its whole length. This will enable us to undulate the sewer at any part, providing we do not rise higher than at any previous point.

With this understanding, I purpose leaving the river just before the St. Katherine's Dock entrance, and diverging by the means of a brick sewer, a little northward, so as to pass underneath, and in between the two first lock gates. Now, the sewer at this part must take the form of a wider arch (I mean more elliptic than usual), and must be as shallow as possible, yet containing rather more internal space or capacity than the main sewer, of which this is a continuation. Now, thus may we pass by every dock entrance that is in the river, without any difficulty whatever, and without even disturbing the ingress or egress of the shipping while it is being formed. Now, when the sewer has passed by the St. Katherine's Docks, it must come out into the river again, and so on until it comes to another dock or inlet, when we must act as we did at St. Katherine's Docks; and in this way we can carry the sewer any distance down the river. Yet, I would advise, that every advantage be taken of the meandering or serpentine form of the river, in order to avoid those tortuous turns the river has. This we can do, by leaving the river at one part, when it is minus of habitations, and falling into it again further on. Thus we may save some miles of sewer; but this is open to correction. Now, I think I have satisfactorily proved these docks, &c., are no difficulty at all to pass, as such we may terminate the sewer at North Woolwich, or elsewhere, where there may be reservoirs to receive the sewerage, as it flows down through this gigantic sewer.\* \* \*

Now, we will consider what improvements, if any, that can be effected in the tributaries to this main sewer: I mean the present existing sewers and drains. Now, as all sewers, without scarce an exception (on the Middlesex side at the least), run into the Thames ultimately, and as my sewer will intercept them all, I do hold it will be unnecessary to make any alteration in any of them, as I purpose offering a plan, by which every parish may effect the flushing out of its own sewers; but when I speak of flushing, I speak of it in its true, legitimate sense,—viz., the flooding, and the sudden, impetuous rushing of a large body of water. Now, in this way we may always keep the sewers clean. Therefore, I would have every parish erect suitable buildings. But here I must observe, that as every parish near the river side will enjoy the flushing of those parishes on their borders, and they in their turn enjoy again those still more remote, therefore it will be as well, if all combine as one body, and establish flushing reservoirs round the borders of the Metropolis, on as good an altitude as possible, so as to command a ready flow to the river; or each parish will establish suitable reservoirs or tanks, for the flushing of their own sewers; and as these reservoirs may be supplied very easily from the mains, and superintended by the workhouse poor, it will entail scarcely any expense, as the flushing need not take place more than twice or so a week. Or, if this be objected to, then let suitable tanks be formed, to travel on low wheels, made in such a way as many may be joined together, water tight, and then let them be drawn to a gully-hole of a sewer intended to be flushed; and here they can be filled from the main; and when a large body of water has been thus collected, of many tons, then let it suddenly issue

forth through a suitable aperture into the sewers ; and when one part of the parish is thus done, let another part be served the same way, and thus may all London be kept sweet and clean.\*\*\*\*\* Now, in very many sewers there is a great quantity of hard compact soil, the accumulation of years, and which will require other than water to loosen it from its hold of the sewer. Now, to effect this, I would, ere a flushing takes place, let down at one gully-hole, a line attached to a cork-float, the other end of the line having a disturber made of iron. Now, when the float has carried the line through a certain length of sewer, let it be taken up through a gully-hole, and attached to a windlass temporarily put over the gully-hole ; and thus may the disturber or dredger be dragged through all the sewers, and thus we shall scrape out and dislodge all that mass of filth that is the cause of so much noxious gas being generated, to the destruction of life or health ; besides, it is much better than thrusting men down these horrid holes. Now, it will be seen, when these hard deposits are once loosened, how easily it will be to keep the sewers clean, by a little flushing. Moreover, when the sewers are once thoroughly free from stagnant soil, the sewerage will have an easier flow ; consequently, the sewers will be enabled to discharge their contents quicker than they do at present.\*\*\*\*\*

Now, as I hope I have expressed myself fully upon all the points necessary to the thorough draining of the city, and the conveyance of its surface and sewer water out of the city, *without contaminating the river Thames, and without disturbing the present area of sewerage*, I shall be expected to say a few words upon the expense. Now, considering the utility of the undertaking, and that it must be made strong, I do not see how it can be done for less than £20,000. per mile. Now, when millions are spent upon the destruction of human life, surely a few thousands may be spared for the preservation of it ; and I am sure the people as a body will cheerfully acquiesce in the outlay, be it what it may. Now, should this sewer be objected to as running along the border of the river Thames, then the next best plan is to sink shafts, and cut a sewer inland, but as near the river as possible, so that all the sewers that now flow into the river, can flow into this main sewer, but it need not be much lower than the bed of the river, providing the ground is suitable for it, but this I much doubt, as I think we shall have to reach the blue clay bed of London ere it can be done ; but in doing this we shall be so liable to land springs, irruptions, fickleness of earth, &c., that like all these deep sewer cuttings, that when perhaps half through, irruption of water or earth takes place, and the work becomes stopped perhaps for years.

Again, I must say a few words upon the accumulation of surface soil : this wholly arises from the gross ill-paved condition of our bye streets, lanes, alleys, places, &c., &c. If London was properly paved (the money that has been levied to effect this object has been most enormous ; so much so, that London ought to have been paved with marble, if not, gold) there would be no accumulation of filth, as



filth only loves to dwell in holes and corners; therefore let London be properly paved and properly drained, and we shall have a city healthy, populous, and happy.

Now, as regards the Surrey side of the Thames, this Margin Sewer will equally do for the Surrey side, as the bed of the river is much below the adjacent levels, and as all the principal sewers have their flow into the Thames, my sewer will intercept them all, and those which do not at present, may, with very little trouble, be made to do so, and as my chief object is to keep the river pure, I see no other way to do it, but by intercepting everything flowing into it, *which my plan will effect, but which no other plan can, unless we upset all our present area of sewers, and lay out and undermine London afresh, which will cost millions and ages to effect.*

I have the honor to be, Gentlemen,  
Your obedient Servant,

(Signed) JOHN SUTTON.

42, Stamford-street, Blackfriars-road,  
25th August, 1849.

T. SWINBURNS, Esq.

Firstly. To promote the health of the Metropolis and other large towns, by doing away with or diminishing those pollutions which have resulted from the miscontrivance of privies and water-closets, and the misapplication of sewers.

Secondly. To render treasurable, and to treasure and distribute for the nurture of the earth, those natural returns that were ordained to be the means of life, but which, from a fatal perversion of the designs of nature, have served only to engender pestilence and death.

These objects would be effected by the introduction, in various forms, of an invention which, by a new and natural economy, and principally by keeping separate, as nature has done, the fluid and solid deposits, will prevent these resources of nature from ever assuming the frightful form they now exhibit, and will enable us to *handle* them, and to direct them to their intended uses of reproduction.

Thirdly. To collect the invaluable manure thus obtained, and to convey the same by our roads, railways, rivers, and canals to suitable depôts in the country, for distribution among the agriculturists.

The execution of the plan would be attended with a variety of important results. The breath of life would be rendered infinitely more pure for the inhabitants of our

towns. Our agriculturists would be enabled to bring their lands into a state of cultivation and productiveness which would enable them to withstand free trade competition. Permanent employment would be given to thousands of our starving population, and great benefit would accrue to all, and to the suffering classes in particular, from the manifold multiplication and consequent cheapening of human food. These, together with the accession of an almost incalculable revenue to the State (to be derived from the sale of the manure), form part of the national advantages to be anticipated from the adoption of the plan.

The advantage which would be felt by private individuals would consist in the reduction of taxation, which would result from an increased revenue—relief, as regards poor-rates arising from the employment of thousands upon thousands of the poor, and the cheapening of food—exemption from the hitherto ever-recurring expenses of cleansing sewers. Besides these advantages, the home of every individual would be secured from the general inconvenience and unwholesomeness of cesspools—from the abomination attendant on the removal of the contents of these places, or on the stopping and unstopping of closet sewers—from the noisome effluvia, which in spite of traps and sewers, not unfrequently contaminates the atmosphere of every room in a house, for, by the invention above referred to, the soil, instead of being suffered to pass into a foul state of fluidity, is immediately subjected to, and continued under, a process of dessication, which dessication in itself, it would appear from experiment, (to say nothing of the chemical purifying effect of the dessicating material) amounts to purification; and to such an extent is this dessication and purification effected, that with receptacles conveniently constructed and located, their contents, though of long accumulation, may be removed in a few minutes at any time, without any sort of annoyance, and at little or no cost.

The plan is distinguished by very extraordinary features. The objects sought to be achieved are of incomparable grandeur and utility. There is no laborious or expensive preparatory work to be gone through—no vast sums of money to be sunk, before the commencement of profitable operations. It might, if desirable, be made to pay its own way.

From those projects of the day which partake of the character of the *cloaca maxima* of ancient Rome, this project is distinguished not only in the foregoing, but the following important points. 1st. That there would be no interference with the property of any man. 2nd. That there would be no reservoirs or accumulation of filth to infect either the town or country. 3rd. That there would be no frightful experiment made upon the public health, by inundating the country with highly evaporable putrescent matters. 4th. That the deadly and costly system of sewerage water-closet filth, instead of being perpetuated would be put an end to. 5th. That not only

would the country be fertilised, but the town would be purified. 6th. That the main sewers, branch sewers, and private drains being relieved from the influx of excrementitious solids, which now pours into them at the rate of many hundred tons per day, would be kept free and open for the natural purposes of drainage, and would consequently cease to entail their heavy periodical expenses of cleansing and reconstruction on the public. 7th. That the manure obtained by the prosecution of this plan would be as concentrated and strong as the wash of the sewer is diluted and weak.

The plan, as the reader may readily conceive, is the very antipodes of the sewer system, both in nature and effect. What has been said of it should be enough to draw the attention of all interested in the subject—and whom does it not vitally concern?—up from the darkness and foulness of the sewers, into clear daylight, to the contemplation of that which is clean and wholesome. The plan *will* do what the sewer system never can—*purify* the towns, while it will enrich the country. Cesspools are shocking things, and must be got rid of—*ergo*, sewers must be substituted for them. This has been our reasoning. It seems strange that the practical results of the conclusion which have so forcibly and so unpleasantly stricken our bodily senses, should not, long before this, have made us suspect that there was some fatal *non-sequitur* in the argument.

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HERBERT L. SMITH, Esq.

Gentlemen,

IT not having been yet determined how to dispose of the sewerage of this Metropolis, I take the liberty to offer the following suggestions to your consideration:—

The desirable object of increasing the supply of water for flushing and cleansing the drains and sewers must greatly increase the difficulty of disposing of the accumulation of tainted and impure fluid collected from so vast an area; but it is certain that, if the water used for cleansing the sewers could be restored to a tolerable state of purity, there would be neither danger nor difficulty in its removal. The more solid matter may be easily disposed of, with advantage, for manure, when the less manageable fluid has been separated from it.

The filtering beds of the water companies afford sufficient proof that filtration is equally feasible on a large as on a small scale. I, therefore, esteem the drainage of cities and towns, by this means, a subject worthy consideration and investigation.

It may, perhaps, be questioned whether any plan which proposes to accomplish this object by a single operation can be realised; at any rate, it would be attended



with great difficulty. The method, therefore, which I have to suggest is, to divide London into such areas, or districts, as may be conveniently susceptible of drainage to one point, and at that point to carry out the means for disposing of the fluid parts of the sewerage, exemplified in the accompanying drawings. Of these designs, the first has no object beyond mere filtration, the second is on a lower level, for the express purpose of affording sufficient pressure to lessen the time occupied in filtration, and thus reduce the size of the bed.

The dimensions given may not be properly adjusted, but, by experiment, this and other particulars might be exactly ascertained. It might, however, be fairly estimated that filtering beds of the size given would, at the least, produce a stream of water equal to from two-and-a-half to three feet diameter.

The sewer is supposed to discharge its contents into a reservoir, which has a surface trap, to prevent a disturbance of the contents of the tank, and is also covered with a wire network to keep down the floating rubbish. A scraper is attached to each filtering bed, to remove any sedimentary accumulations; it is worked by external means, as shown in the plan.

The most fluid portion of the drainage rising naturally to the surface is allowed to flow over the filtering bed, and, passing through, issues from it in a purified stream, the water may then be safely conducted into the river, or elsewhere, as most convenient.

The apparatus is represented double, that during repair or cleansing the work of filtration may be uninterrupted.

I have the honour to remain,

Gentlemen,

Your most obedient servant,

(Signed)

HERBERT L. SMITH.

2, Sloane-terrace, Sloane-street.

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CHARLES SANDERSON, Esq.

*To the Honourable Commissioners of the Metropolitan Sewers.*

My Lords and Gentlemen,

IN compliance with the resolution passed at your Court on the 20th instant, I beg to lay before you "a concise statement" of my "Plan for effectually draining the cities of London and Westminster, and all that district embraced by Mr. Philips' Report."

Instead of having one main sewer, or tunnel, I propose to have *a main sewer on each side of the river Thames*, and quite independent of each other. The north sewer extending from Twickenham to the Plaistow Level; and the south one, of rather smaller capacity, extending from Richmond to Plumstead Marsh, at Woolwich. These main sewers to be formed of *wrought-iron*, and to be laid on the mud banks, between high and low water, excepting certain portions, which take a more direct course by land, and in which case it is proposed to form those *portions of brick*.

At every quarter of a mile along these main sewers would be placed *flushing pipes*, up to high water, with proper valves, thus furnishing a ready means of cleansing the sewers when occasion requires. At the termini of the two main sewers, it is proposed to have *receiving ponds*, into which the sewage would be lifted by *scoop-wheels*, worked by four engines of an aggregate power of 250 horse. The wastewater, passing off by a *tidal sluice at low water* into the Thames from subsidence ponds, which latter are not essential to the mere riddance of sewage water, but might form part of an independent scheme for the consideration of contractors in supplying sewage manure. Having thus shown simply what the leading features of the scheme are, I will briefly describe the *route of the two main sewers—their form—cost of each*—and conclude with a remark on the *branch drainage*—which, so far, I have been obliged to omit, almost altogether, on account of the shortness of the notice.

*The north sewer*, I propose, should begin in Twickenham, about twenty feet under the surface, and seven feet under high water spring tide, then follow the road to Isleworth; there enter the river with wrought-iron, and, passing Brentford, emerge at Strand-green; thence cross over to Chiswick, take river again until past Hammersmith-bridge, and, emerging, strike across by Walham-green into the river again at Chelsea; thence, following the north bank, emerge at Temple-pier, where would commence a brick portion, to be tunnelled part of the way, in passing along Upper and Lower Thames-street, Ratcliffe Highway, and Limehouse; then north of East India Dock-road, under Bow Creek, and terminate in Plaistow Level, thirty-five feet below high water spring tide. This main sewer falls 1 in 3400 and 1 in 3000. Its height varying from *four feet six inches to eight feet* at the lower end, and proportionably wide. Length,  $18\frac{1}{2}$  miles.

*The south sewer* would begin at Richmond, six feet six inches under high water spring tide, pass along the turnpike-road to Mortlake, and over Barnes Common to Putney, thence take the river all the way to Bermondsey Wall; here, leaving the river, pass along the Deptford Lower-road, and enter the Thames again at Deptford Creek; emerging again, below Greenwich, and passing the marshes, then entering the river, pass Woolwich, and finally emerge at Plumstead Marshes, thirty feet below

high water, spring tide. Here would be a receiving pond, scoop-wheel, and engines. This main sewer *falls* 1 in 4050 and 1 in 3000, and its height varies from *four feet six inches to seven feet* at lower end. Length, twenty miles.

*The description of wrought-iron sewers.*—To be of the best boiler plate, half inch thick, riveted together in lengths of forty feet, with lap joints; the section to be egg-shaped, with the bottom flattened off, and the area to be about thirty-two feet at the lower end. To be supported on slight masonry where the bed of the river needs it.

The portions of the main sewers in brick, I propose should be *one foot or one foot six inches larger in diameter* than the iron portion, on account of the greater friction.

*Cost of the two main sewers*, including receiving ponds and engines to each, will be about—

18½ miles of north sewer, £296,000  
20 miles of south sewer, £297,000

Although the southern sewer has the smallest capacity, yet its being lengthened to take in Greenwich and Woolwich occasions the greater cost.

*The branch drainage* will have ample fall into these main sewers, the bottom of King's Scholars'-pond Sewer being twelve or fourteen feet above the bottom of the proposed north sewer, thus affording facilities for tunnelling under all *existing* main sewers, and leaving them undisturbed during progress of works. The surface drainage would then be left free to find its natural outlet into the Thames, without contaminating its waters.

The advantages of this system of main drainage over the tunnel system are fourfold:—

*First.* All the hazard and danger of tunnelling under the bed of the Thames is avoided.

*Second.* A great saving in cost effected. The Thames Tunnel cost hundreds of thousands more than was ever expected.

*Third.* Two thirds of the drainage lying on the north, or the remaining third on the south, can be accomplished independently of each other, if necessary.

*Fourth.* A great saving in cost, in connecting branch drainage with the main



sewers, inasmuch as a tunnel with a limited number of shafts, must entail a great extra length of branch sewer, or, what is worse, branch tunnels to the main.

I am, my Lords and Gentlemen,

Your most obedient humble servant,

(Signed)

CHARLES SANDERSON,  
Engineering Surveyor.

2, Baker-street, Reading,  
Aug. 23, 1849.

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B. G. SLOPER, Esq.

*To the Honourable the Commissioners of the Metropolitan Sewers.*

Honourable Sirs,

I THINK that every one who has had occasion to walk about London to-day, will bear evidence to the extremely fœtid state of the atmosphere. The whole air was impregnated with a warning vapour, and at every gully-hole a stream of cool air and vapour issued forth, of the most pestilential character. I have seldom found the sewers to send out a more putrid smelling air, or in greater abundance than what was poured from all the gully-holes this day. The City did not stand pre-eminent on this occasion. The districts of the Metropolitan Commission were equally bad. The sewers at the heads of the great falls in the Strand, and in similar positions, gave out as awful a stench as those more favourably situated for benefitting by the operation of flushing.

The sky was at times without a cloud. The thermometer ranged between seventy and eighty degrees in the shade; a pleasant breeze was blowing from the south. These, with other circumstances, not appreciated, favoured the remarkable flow of air charged with putrid vapour from the sewers which loaded the whole lower atmosphere of London with stench diluted, but perceptible throughout, and fearfully predominant in the vicinity of the gully-holes.

The experience of to-day is conclusive, that under such atmospheric circumstances as occurred this day, whatever those may be, the operation of flushing the sewers, even in the most favourable situations, is inoperative, either as a preventive or diminutive of the pollution of the external air, so long as the gully-holes are untrapped.

I speak of my studied experience of to-day, when the whole atmosphere was offensive, and the air from the gully-holes and spinal vents was poisonous, compared with the atmospheric pollution caused by the fouling of the Thames, of which so

much has been written. The poisoning of the lower stratum of air in the London streets is a monster evil infinitely greater; and as there is no doubt of the fatal influence of atmospheric impurity on health and disease, I feel assured that if the sanitary records of this day be consulted, there will be found to have been a great increase of disease, even in (what are considered) the best ventilated streets.

One means of remedying this destructive evil, viz., the pollution of the air of London by the sewers, is to trap the gully-holes, and close the spinal vents.

The gully-holes have been left untrapped, however, on principle; a principle which I think and will endeavour to show is erroneous. It has been conceived that by trapping the gully-holes a greater evil would result than allowing the atmosphere of the streets to be rendered poisonous. It is stated, that the air which now passes from the sewers into the streets would be forced into the houses through the house drains, were the gullies trapped. This would of course be a greater evil if it should be so, or if there were no means of preventing it; and it would be so, of course, if any force were allowed to act on the air in the sewers. Then, if the air acted on had no means of escape, or of yielding freely to the propelling force pressing on it and producing its motion, by means of free vents, or traps, equivalent in their small quantity of resistance to free vents, it would of necessity be forced through the house drains, and infect the houses with a less diluted poison than we breathe in the streets; the evil would then be greater. But, suppose that you trap every vent into the sewers, not only the gully-holes but the outlets, to do which there is no difficulty, the air included in the sewers will be quiescent, there will be no force in action to propel it either into the streets or into the houses, and you will remove the destructive nuisance of atmospheric pollution by the sewers, both in the streets and in the houses.

I think that the stench from the gully-holes arises from currents of air passing along the sewers, which sweeping along the surface of the liquid absorbs vapour holding in suspension animal and vegetable matter in a putrid state. If I am right, and that no other force is in action to produce any motion or expansion of the atmosphere of the sewers, the giant evil of the infectious atmosphere caused by the sewers may be safely remedied by trapping every outlet, and closing the spinal vents.

I believe it has been alleged, that the gases produced in the sewers must have vent. On this point I may observe, that if vast accumulations of filthy deposit were allowed to exist, the hydro-carbon and sulphuretted phosphorated hydrogen would of course be evolved in small quantities, under some favourable circumstances; but I have no hesitation in affirming that at the present day, under the system of flushing, which you are carrying out to its full extent, there are no gases produced in the sewers capable of producing a pressure by their elasticity on the volumes of sewer

atmosphere. Time, repose, and favourable circumstances are required for their production from such materials. I have experimented both on the sewer deposit and sewer liquid on this point, and am satisfied that the only force to be combated is that of the external air in motion, which enters at the vents, and blowing through the sewers, and sometimes apparently coming out of the gully-holes all at the same time, is the feeder of pollution and malaria to the external atmosphere of our streets, and will continue to be so as long as the house drainage has a free communication with that atmosphere.

I had proposed to offer some suggestions on the principle and form of a gully-trap, but as my views may not be approved of, and I might therefore be only wasting time, I will wait your pleasure on this head before I attempt it. With great respect, I have the honour to subscribe myself,

Honourable Sirs,

Your most obedient servant,

(Signed)

B. G. SLOPER.

14, Gloucester-terrace, Kensington,

6th July, 1849.

*To the Honorable Metropolitan Commissioners of Sewers.*

Honorable Sirs,

As I find, on enquiry, that my communication of the 6th instant, will not (on account of the precedence of other subjects) be laid before you until the 30th instant, I take leave to avail myself of the interval to enter into some further details relative to the subject.

The principle which I recommend is, trapping every opening into the sewers, whether gully-holes, *outlets*, man-holes, or air-holes, of every kind, by which means, the pressure of the external or atmospheric air, in motion, cannot produce draughts in the sewers, which now cause the discharge of vitiated air from the gully-holes and air vents into the streets and untrapped openings of the houses.

I think that if the external air be prevented from entering the sewers, by trapping, there will be no force in action in the sewers themselves, by which the air they contain would be propelled, either into the streets or into the houses, or in such small quantities, at particular times, as to be comparatively inappreciable and harmless. I have examined, chemically, the sewer water and deposit, and I am satisfied that the odour of the sewer air does not arise from any gases having permanent elasticity capable of producing a propelling force in the sewers to any amount.

The odour which, is one, *sui generis*, arises from a vapour, taken up from the sewer liquid by the air in contact with it, and which bears with it putrifying vegetable



and animal matter and other products, and has no greater elasticity, and exercises no greater pressure, than that of the external atmosphere. It would be necessary, however, to arrange, that there should be air-traps on the gully-traps, allowing egress of the sewer air, and preventing the ingress of the external air.

The volume of air in the sewers is variable; there is, what may be called, a daily tide in the sewers, which reaches its maximum about eleven or twelve o'clock in the day, when the house drains are pouring their contingent of liquid in greatest abundance into the sewers, and reaches its minimum some time after midnight. The volume of the sewer water, as it increases and approaches its maximum, displaces an equal volume of air in the sewers, which, if it were not allowed to escape into the streets, would be forced into the houses; but the quantity of air so displaced daily would be extremely small, and as its discharge into the streets would be distributed over several hours, its presence would scarcely be observable. To allow the gradual escape, however, of this air, or of a greater volume of air displaced during storms, I propose to place membranous slightly-elastic air-traps on the gully-traps, which would entirely prevent the ingress of air into the sewers; but opening outwards, under an almost inappreciable force, would allow its exit. The principle of such trap would be that of an air-pump.

On the fall of the tide of sewer water, air will find its way into the sewers, either through the water traps of the house drains or through small openings, which, in such an extensive system, it would be impossible to prevent.

The same air traps would provide an escape for the air at the rise of the river tide, which heads up the sewer water at the various outlets below high water, and displaces an equal volume of air.

It may be thought that the men working in, or flushing the sewers, would require them to be ventilated to a greater extent, which could be done, if absolutely necessary, without allowing the present system to continue. I do not think it would be requisite if the warmer air of the atmosphere in summer were prevented from sweeping through the sewers; the cold air of the sewers would be charged with less vapour than it is at present, because air dissolves a liquid, and favours its conversion into vapour, in proportion to its temperature. There is no reason to apprehend either that there would not be plenty of oxygen for their respiration; the daily influx of atmospheric air on the sinking of the sewer water level would supply an abundance. It is possible, however, that occasional ventilation might be desirable. During the process of emptying cesspools into the sewers, sulphuretted hydrogen, and its compounds, are liberated very abundantly; and, therefore, subsequent to such operation, the ventilation of the sewer, or some other effective method of destroying those gases, would be indispensable. There is no reason why such should not be

adopted ; or why, on account of difficulties which are by no means insurmountable, the sewers should be allowed to be sources of poisonous vapour, projected by and from their openings, diffused at certain times through the whole lower atmosphere, and circulating with the draughts of air through every house in the Metropolis.

The plan I propose to remedy this, is of immediate application. To begin by trapping an outlet, then the gully-holes nearest to it, successively ; at the same time, internally trapping the sewer across the current, by a moveable apparatus, if it should be found necessary, during the progress of the work. In a few months the whole of the metropolitan gully-holes might be so trapped ; no air would enter the sewers through any of such openings, and only a *measured quantity* be allowed to escape from them, and this extremely small, in comparison with the present abundant flow.

I wish to confine myself to the specific subject of this communication. As connected with it, however, I may observe that the proposals for separating the house drainage from the surface drainage have been made, principally with the object of preventing the pollution of the atmosphere. There is no other sufficient reason for the separation, and the great outlay it would entail. I believe that object may be effected by the very simple and inexpensive means I have suggested, without the outlay and delays attendant on a new system, yet untried, but with the means at present at our command in the sewers already constructed. The great question of carrying off to the outlet, both the surface and house drainage, without poisoning the atmosphere, would then be settled, leaving the minor problems of the non-pollution of the Thames, and the application of the sewage, for more mature consideration and experiment.

I have, the honour to be,

Honorable Sirs,

Your most obedient and humble Servant,

25th July, 1849.

(Signed)

B. G. SLOPER.

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HARCOURT THOMPSON, Esq.

My Lords and Gentlemen,

IN accordance with a resolution passed on the 20th instant, I now submit a concise statement of my proposition for a perfect system of drainage for London and its dependent suburbs.

In the first place, I avail myself not only of the dip of the land from the northern and southern boundaries of the Metropolis to the river Thames in the centre, but also of the rapid declivity of the river eastward, by constructing one

main drain sewer along the river side, inshore to which all other sewers will be tributary.

For the north side of the river, this main sewer would extend eastward to a point between London and Southwark bridges, and then to avoid dock entrances turn into Thames-street, whence it would be continued in the most eligible direction to its terminus in Romney or Westham Marshes, where reservoirs would be formed for the reception of the sewerage and the precipitation and consolidation of its fertilising elements; the same principle is applicable also to the south side of the river.

Secondly. Inasmuch as there cannot be a more fatal, or less scientific method of constructing sewers than that of forming their junction at right angles, and that to this cause is to be attributed the large accumulations in them, and the necessity for frequent cleansing operations, a main feature of my proposition is a system of converging arteries leading eastward, and the junction of all collateral sewers with them at *acute* angles instead of *right* angles, coupled with a judicious arrangement of flushing points, by which means I accelerate the current in the direction of the outfall, thereby preventing the precipitation of particles, which cause the obstructions complained of under the present ill-devised contrivances.

Thirdly. I submit a plan for preventing the escape of noxious gases from sewers : a most sanitary desideratum, combined with an improved mode of admitting street drainage, and at the same time excluding road detritus, a fruitful cause of obstructed drains.

Finally. Where the sewer follows the course of the river, I propose to protect it by a wall, to which all wharves will be extended. By this arrangement the water carriage of goods and passengers will be greatly facilitated, and the appearance of the river materially improved; the wall combining the advantages of wharfage, sewerage, and a happy medium for the induction of water to all parts of the Metropolis.

My Lords and Gentlemen, I have the honour to remain,

Your obedient humble servant,

(Signed)

HARCOURT THOMPSON.

5, Clerk's Terrace, Lewisham-road.

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Messrs. TATE and GILMORE.

Westgate, Newcastle-upon-Tyne,  
August 13, 1849.

*To the Sewerage Commission.*

Gentlemen,

THE importance of the subject is our excuse for troubling you with a second communication on the sewerage question.

An objection may exist, not only to the river from which London is supplied with water being made the deposit for so much impurity, but to the waste of ammonia (so essential to agriculture), which our former plan proposed. We have therefore reconsidered the matter, with a view of rendering *tunnels* unnecessary, and drains too, except for day water and ordinary purposes, saving the solid and liquid excrements of the people to give back to the land, preserving the river and the air from being contaminated by such excrements, and human life from being thereby destroyed; and we hope the following *simple plan*, which we will briefly attempt to describe, will be found *sufficient* to secure these objects.

The discharge from each and every *convenience* to be conveyed by a pipe of sufficient diameter for such discharge, the pipe to be the required length, and to have a screw collar at the end to fit an orifice or hole in the top of an *iron* cistern, or tank; the rim of the hole in the tank to project about four inches, into which the pipe shall screw, and a collar to cover the joint to make it air tight.

The cistern or tank to be on wheels, and placed in a proper out-building, back yard, or other suitable place, and to have an apparatus attached, to indicate the quantity it contains. The pipe and tank to have each a slide valve, two inches or so from the mouth of each, to confine the contents when separation is necessary, and a full cistern is to be replaced by an empty one. The loaded tank to be drawn to a railway provided for that purpose, and thence carried into the country for sale or deposit till wanted for the land. The tank to lift off its own carriage by crane into carts, &c., or into the various depôts. The lower part of one end of the tank to screw up by a small lever to the required height, to discharge itself on the land.

The farmer that fears offence or waste of ammonia, can provide a simple vehicle, which will carry the cistern, form a bed for the manure, deposit it, and cover it over in one act, without loss or danger. Ash-houses in yards ought to be constructed on the same locomotive principle, conveyed by the same means to the same destiny, and if required, mixed with the night soil on the land.

Each water closet to be constructed so as to allow only as much water to escape as will be necessary to cleanse the vessel.

If the value of ammonia (according to Dr. Liebig) in the production of crops was once understood and appreciated by agriculturists generally, a market and price for the manure would be obtained, which would return not only the first outlay on the adoption of this plan, but be perhaps a source of revenue to the state,

Hoping you will do us the honour of receiving our humble suggestions, prompted, as they have been, by our hearts' best wish for our kind and country,

We are, Gentlemen,

Your humble and obedient servants,

(Signed)

Messrs. TATE and GILMORE.

To the Sewerage Commissioners, London.

## LABOR OMNIA VINCIT.—W. W. C.

### THE OCEAN SCHEME.

IN proposing any plan for the drainage and sewerage of the metropolis, it is my opinion that the scheme should embrace, not only the Metropolis and its immediate neighbourhood, but the entire kingdom.

I assume as the incontrovertible datum of my scheme, that, under all circumstances, the ocean is the *natural outlet* or *sink* for all the waters that accumulate on the earth's surface.

Nature herself sets the example, in her streams and rivers all finding their exit in the ocean.

Taking nature as a guide, I propose that as these streams and rivers carry off the surface water, so artificial channels should be made to carry off the sewer water to the ocean.

Each of these artificial channels should commence from some town or town in the interior, and, as trunk lines, taking different directions, should carry off the sewer water of all the towns and villages on their passage to the sea.

I propose that engine-pumps should be placed at convenient distances along the trunk lines, to insure a pressure equal to the distance to be traversed.

As an illustration of my plan, I will take London as one central point. My proposition is—instead of, as now, allowing the sewer water to be discharged into the river, it should be taken up at various points (to be hereafter determined on), and then be conveyed, by these artificial channels in every direction, to the sea. For instance, on the South side trunk lines might diverge through North Kent, Mid Kent, Surrey, Sussex, and Hampshire, taking the sewer water of the various towns they pass, and carrying it to the sea, always at some point far from any habitation. In the same manner on the North side of the river, trunk lines might diverge through Middlesex, Essex, Hertford, Cambridge, Norfolk, and Suffolk, in their passage to the ocean. And thus, from one point, a quarter of England might be thoroughly relieved of its sewer water. And in the same manner, forming artificial channels from other towns, the whole country would be placed under one vast and comprehensive system of drainage and sewerage.

The size of these channels, which might be of brick or pipes, must depend on the number of population of the towns any trunk line might pass along; but as I propose that this sewer water should be distributed as manure on the land each line passes in its course, it would be found, in most cases, that the trunk lines could be constructed of pipes, and consequently at little comparative cost. In this manner the country would be placed under one comprehensive and enormously advantageous system of irrigation.

The pipes might be laid at from six to ten feet under the surface; and there would be no outlay for land, for it would be to the manifest advantage of the landholder to have a trunk line, as a means of sewer irrigation, close at hand.

I assume that chemical means would be employed to destroy any noxious effluvia that might otherwise arise from irrigating with sewer water.

In comparison with the difficulties that have been overcome in an engineering point of view in the construction of the net work of railways that already exists, it is clear that the difficulty of laying down these artificial channels would sink into insignificance.

The practicability of the scheme, therefore, does not admit of a doubt. The only question is one of expense; but according to many calculations that have been made, the consumption of the sewer water as manure would, in all probability, realize a large income, sufficient to warrant any outlay. The sanitary condition of the population is, however, the first consideration, which would, by the carrying out the *ocean scheme*, be placed for ever on a sound footing.

LABOR OMNIA VINCIT. ——— W. W. C. .



EDWARD WHARMBY, Esq.

21, Halliford-street,  
Lower-road, Islington.

The plan proposed is for the purpose of preventing foul air rising from the sewers through the gully-hole gratings, to the streets, and to be applied either to the present, or any subsequently determined upon mode of street drainage.

The main features are, that by the adoption of the trap, figs. 4 and 5, ample room will be afforded for the quick passage of all water from the surface, while sufficient being retained in the lower end (and that of the purest quality, from being the last passing through the grating) the ascending of any impure air to the streets is effectually prevented. That these traps will never require cleansing, as the rush of water passing directly along the bottom, will carry stones, and everything passed through the grating, before it, there being no room for any deposit of filth to be made in the lower end. And that the plan of ventilation proposed will not only remedy the inconvenience and danger attendant upon trapping all the openings, but also effectually purify the interior of the sewers, so as to render them safe to the men engaged in cleansing them.

For the detail I would beg to refer the Honorable Commissioners to my letter of the 13th instant, accompanying the plan, but as conciseness is required, I repeat in this statement portions from it.

Fig 1.—An iron gutter having the grating united to it, the grating opening with an hinge, that in emptying cesspools or other repositories by the flexible hose, the hose might be passed entirely through the traps, (figs. 4 and 5), and that if occasion ever required, it might be cleansed, and the bars of the grating being placed lengthways with the gutter, offers less resistance to the passage of the water, than the one at present used.

Fig. 2.—A section of the proposed grating, showing an unimpeded passage of water, &c., through the bars, the form of which being wedgelike (the thin end downwards) gives a more free passage to the water, and all that floats with it, than the present grating, a section of which is shown (in fig. 3) with the accumulated corrosion of its sides, and dirt adhering to it.

Fig. 3.—The section of old grating before referred to, the dirt, &c., adhering to the sides of each bar, forming openings **V** shaped, and offering a resistance to matter floating in the water, and inducing a complete stoppage, whilst fig. 2. offers nothing for such matter to rest upon, and the force of the water falling will effectually pass all accumulation through the opening.

Fig. 4.—Section of trap, which, by remaining at all times charged with water to the dotted line, would effectually prevent any smell coming from the sewers to the streets, and would hold a sufficient body of water to allow for the evaporation consequent upon a long continuance of dry weather, without its descending so low as to cause an opening, allowing passage to the foul air. The lower portion of this trap might be of glazed earthenware.

Fig. 5.—Section of another trap, adapted to the brick openings under the present gratings (sooner adopted, and at less expense, than fig. 4).

Fig. 6.—Grating for centre of road, similar to that at present used; but to be larger, and made to open for the use of the ventilator (fig. 7.)

Fig. 7.—Ventilator, or large canvas tube, open at the side, near the top, to be suspended over, and the end inserted in, the opening of grating (fig. 6). The opening at the side being turned to face the wind, a strong current of air will be forced into the sewer, and by passing swiftly in the direction of the arrows in fig. 8, drive out the foul air at the mouth of the sewer with sufficient force to disperse it immediately; or might be used only for sweetening the air of such portions of the sewers as men at the time may be engaged at work upon.

Fig. 8.—Section of a portion of sewer and ventilators, as proposed to be used.

Having, since sending in my plan, seen the traps and gratings recently laid down in the neighbourhood of the houses of Parliament, I beg most respectfully to observe, that, from their having the tube by which the water is to make its exit placed at the middle of the barrel, a large space is left at the bottom for an accumulation of every description of filth that may be passed down the grating, which, by being retained, and rotting there, will render the water contained in these receptacles very impure, and cause it to emit more smell than would have arisen through the grating if it had not been trapped at all: it will require constant attention in emptying and cleansing, and afterwards refilling with water, to make it at all bearable; and, from the narrowness of the tube, it will not allow the water to pass away fast enough to prevent the streets being flooded; and in a violent shower it would, in all probability, become stopped by the force of the water in its attempt to pass some of the deposit contained in its lower end through this narrow opening. And I do not think they will hold for any length of time sufficient water to prevent the effluvia from the drains passing upwards to the surface.

(Signed)

EDWARD WHARMBY.

25th August, 1849.

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FREDERICK WOOD, Esq.

No. 6, Franklin's-row,  
Queen's-road (East), Chelsea,  
August 25, 1849.

*To the Right Honorable and Honorable the Metropolitan Commissioners of Sewers.*

My Lords and Gentlemen,

IN compliance with your advertisement in the "Times" newspaper of July 24, 1849, I beg to offer my suggestions as the only profitable mode of converting the sewage of London, &c., so as to reduce the same into capital, to the relief of the rate payers from the large necessary outlay occasioned by diverting the London drainage from entering the Thames.

For the foregoing purposes, I suggest that sewers of sufficient capacity be constructed on the north side of the Thames, commencing at Bridge-street, Blackfriars; the crown of which to be of a level equal to receive the lowest drainage at that site, continuing the same east and west, with falls sufficient to be below the lowest like drainage of the said east and west lines, as well as all other needful avoidances to be met with during the progress of the same, which I propose to extend east to Rainham Creek, and west to the Powder Mill River, Hounslow Heath, which river and creek may be used as receptacles for passing off all superfluous waters, after extracting the manure from the sewage.

And in like manner I propose similar sewers on the south side of the Thames, commencing in the Blackfriars-road, by Rowland Hill's Chapel, eastward terminating at Dartford Creek, and westward terminating at Berryland's Farm, next Hogg Mill River, Kingston; or such other shorter terminus if similar advantages of outlets can be obtained, it being desirable that water carriage should be had as near each of the said terminuses as possible for conveying the manure to various parts of the country, as well as fuel to the terminuses for the purposes of the works; the one giving a serious increased value to the manure, and the other a great saving in the carriage of fuel.

Your Honourable Board will please to observe, by thus diverting the sewage of the Metropolis of London to four terminuses, the profitable extraction that is to be made therefrom, will (as before recited) be increased in value by the same being conveyed to four distinct agricultural markets, without any increased cost to the Commission, except as to the terminuses or depôts; and that but to a small extent, inasmuch as the four depôts may each be proportionally reduced in magnitude to what they would be, were there but one depôt; and such increased cost of the extra depôts would not bear any proportion to the increased value of the manure.



Your Honourable Board will be pleased to observe, I propose that my plan shall be of sufficient magnitude to receive the contents of all existing drainages, as well as those to be hereafter constructed, with falls sufficient for their necessary currents.

I also propose that the eastern and western line of each of the said sewers should be connected at their highest part, thereby rendering them auxiliaries in the event of any extraordinary storms or thaws. Having thus conveyed the sewage to the four terminuses, I propose a shaft to each, with proper lifting machinery to raise the contents into the depôts or receptacles; and I beg most respectfully to subscribe myself,

My Lords and Gentlemen,

Your obedient servant,

(Signed)

FREDERICK WOOD, Surveyor.

#### PROFESSOR WALLACE.

ASSUMING, for reasons stated in my letter to the Honourable the Commissioners of Sewers, 4th August, 1849, that it is impossible to drain the Metropolis in an effectual manner, without an abundant supply of pure water, for the purpose of washing out and cleansing the sewers and drains of London every day, and of carrying off all the sewage and filth, *in a diluted state*, into the River Thames,—I propose, *in the first place*, to bring a supply of pure water into the Metropolis, adequate to the great object in view, and superior to that of all the existing water companies combined, by means of *gravitation*. I would select a site for a *vast reservoir*, as near London as possible, and on a sufficiently elevated level for the purpose, capable of containing *two thousand millions of cubic feet* of water, or more than *than twelve thousand millions of gallons*, a quantity nearly equal to the whole of the *annual supply* of all the water companies of London. This site should be formed partly by nature, and partly by artificial embankments. Into this vast reservoir, I would collect all the surface-water of the surrounding country on a higher level; all the natural streams and springs in its vicinity similarly situated, and all the water of any river or rivers which could be made available for the purpose, to constitute *an unlimited source of supply*. I would then filter (in a peculiar manner, known only to few, but the best yet discovered,) the whole or part of the water in this reservoir, according as the nature of its situation and form would admit, and convey it, in an aqueduct, to a suitable reservoir, in the most elevated part of London or its vicinity; thence, to be distributed in the usual manner, through pipes, to all parts of the Metropolis and its environs.

I propose, *in the second place*, to increase the number and efficiency of the common sewers in London and its suburbs, so that there shall be one, at least, in every street; that all cesspools and privies shall be removed; that, in their stead, all sinks and water-closets shall be furnished with drains leading to the common sewers; that every householder shall be obliged to have a sufficient supply of water laid on his premises, for the purpose of washing out and cleansing his own drain, and driving its contents into the common sewer; that inspecting officers be appointed to see that *this is done daily*; and also to wash out and cleanse, by means of water laid on for the purpose, the common sewers of every street, and to drive their contents into the great leading common sewers; and these again to be similarly treated, until the whole of the Metropolitan and suburban sewage and filth of each day be carried off, and thrown, *in a diluted state*, into the Thames.

I propose, *in the third place*, that certain improvements be made in the River Thames, by which the operation of the tides, in carrying away the *sludge* of London and its environs, would be rendered more rapid and effectual. These are, *first*, the narrowing of the breadth of the river, or confining its waters within a given channel, by the erection of dikes or sea-walls along its shores, from Teddington to the Nore, in order to prevent them from spreading beyond the channel on both sides, and thereby increasing the breadth of the river to the diminution of its depth. Thus, marshy ground would be rendered useful; the degradation of the banks, and the formation of shoals would be prevented; the river would be rendered more navigable, both at ebb-tide and high-water; the velocity of the tides and the river would be increased: and the sewage and filth of the Metropolis would be more rapidly engulfed in the great cesspool of the world—the ocean. *Second*. The constant employment of dredging machines in various parts of the river, in order to clear the channel of every obstruction that might possibly arise from the sewage; and thus to cleanse and purify the river, so as to remove the shoals that might be formed by such obstruction, and greatly increase the facilities of navigation, especially for steam vessels.

(Signed)

R. W.

Dalston, Middlesex, 23rd August, 1849.

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Z. A.

#### GRAND METROPOLITAN SEWER-DUCT.

The main principle of the above plan may be stated in three or four words, as it only consists in the combination of a Tank, a Pump, and a Sewer-Duct, *above ground*.

A large tank or basin built below the surface, and also built over, so as to be air-tight, would constantly receive a grand junction outfall of house and soil drainage; which would be as constantly pumped up to a height, probably never exceeding thirty feet *above the surface*, where it would be discharged into an air-tight Sewer-Duct at the above, or a less elevation, running down on an inclined plane to a given distance, and discharging itself at a dépôt.

There would be four, and perhaps five, of these Grand Sewer-Ducts, each taking a different course. And there would be six dépôts; the two largest towards the sea, the others inland.

Z. A.

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Metropolitan Sewers.

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CONCISE STATEMENT

OF

THE MAIN FEATURES

OF

THE PLANS

FOR

THE DRAINAGE OF THE METROPOLIS

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SENT IN PURSUANCE OF THE RESOLUTION OF  
THE COURT, 20<sup>TH</sup> AUGUST, 1849.

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By Authority:

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